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View Looking East Along the Roadway, showing Track for Sluice Regulating Gear.

Photos. by courtesy of
Sir John Aird, the contractor.

Asyut Barrage Across the Nile; Upstream Side Looking West.

THE DAMMING OF THE NILE.—[See page 152.]

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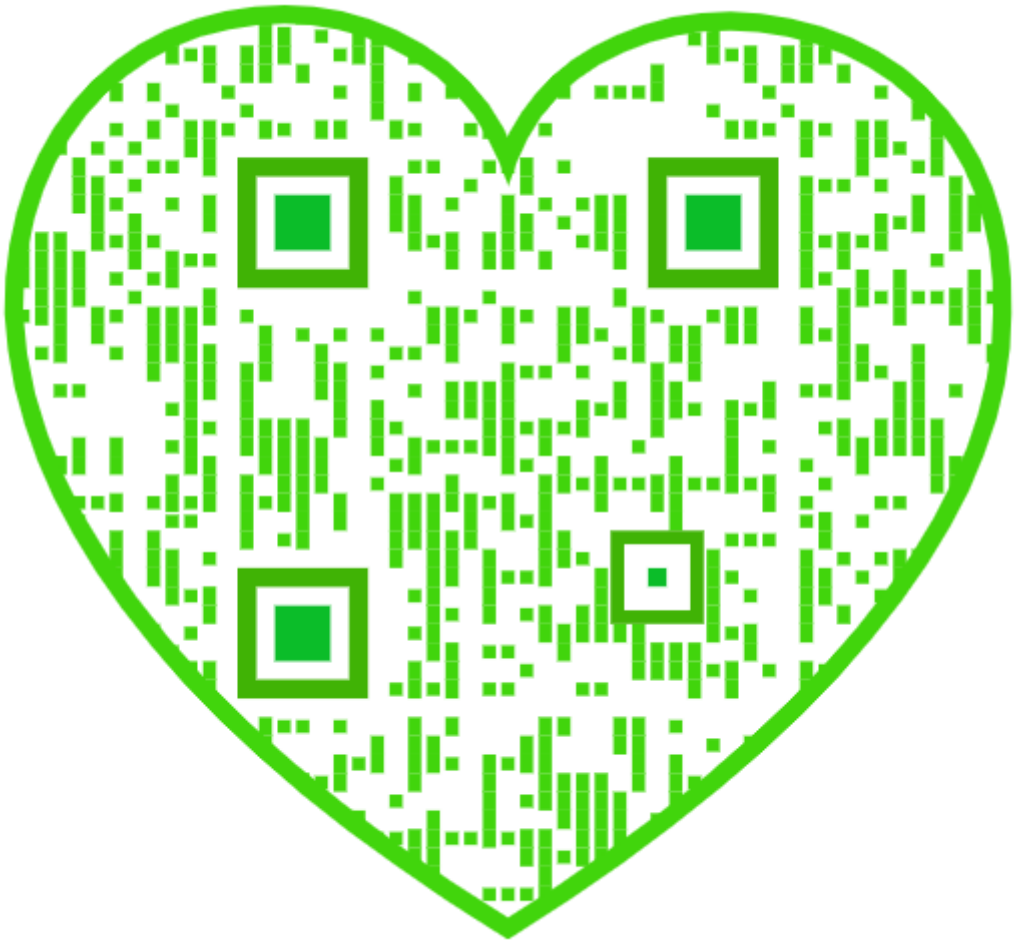

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NEW YORK, SATURDAY, FEBRUARY 28, 1903.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RAPID AND SLOW CONSTRUCTION OF PUBLIC WORKS.

The SCIENTIFIC AMERICAN takes particular pleasure in presenting the handsome series of views that appear in this issue of the second great dam or barrage across the Nile, known as the Asyut dam, for the reason that this is the first official description of this important work to be made public, in this country or abroad, the facts and photographs having been communicated to our special correspondent by Sir Benjamin Baker, engineer-in-chief of the Nile irrigation works. The Asyut dam is not to be confused with the Aswan dam, which was fully described and illustrated in our issue of September 20, 1902. The Aswan dam, which is the larger structure of the two, is located on the Upper Nile, 600 miles to the south of the city of Cairo; the Asyut dam is built across the Nile at a point 350 miles to the north of Aswan, and therefore 250 miles to the south of Cairo. Both of these works form part of a stupendous irrigation project carried through by the British government for the betterment of the Egyptian agriculturist in the Nile valley. The importance of the work and its far-reaching beneficence are not overestimated by our consul-general at Cairo when he says, "The boldness of the idea and the thoroughness of the undertaking rank with anything that has ever been done in this land of Titanic achievements. It may be, indeed, doubted whether any of the great works of Egypt has had so beneficent an effect on this country as will this great engineering triumph." Egypt is essentially an agricultural country, and the success of its agriculture depends absolutely upon the water furnished by the Nile. The works which were inaugurated December 10 of last year will not merely increase the cultivable acreage by 15 per cent, but it is expected that they will double the number of crops that can be gathered each year from the land now under cultivation, while the cotton industry alone will experience an increase of 25 per cent.

The project is justly described as Titanic. The great dam at Aswan is 1¼ miles in length, 22 feet in width at the top, 100 feet wide at the bottom, at its greatest depth, and has a maximum height of 130 feet. It is pierced by 180 sluices, 140 of which are 23 feet high by 6 feet 6 inches wide, and the balance 11 feet 6 inches high by 6 feet 6 inches wide. When they are closed the waters of the Nile will be raised to a maximum height of 67 feet above the normal height of the river at this point, and in the great reservoir thus held back in the Nile valley will be no less than 280,000,000,000 gallons of water. In the dam itself there are over 1,000,000 tons of masonry. The contract time for the construction of this huge work was only five years; but such was the assiduity of the contractors that it was completed in four years, or twelve months less than the contract time.

The Asyut dam, though not so large as the one further up the Nile, is, as shown in our illustrations, a gigantic structure. It measures over one-half a mile, or 2,750 feet in length, and its massive wall is pierced by 111 bays or sluices, each 16.4 feet in width. Before erecting this barrier it was necessary to provide a foundation of solid masonry 10 feet in average thickness, 87 feet in width, and half a mile long; and it was necessary to build temporary dams on the up and down stream sides of the dam, and pump out the water before a foot of the masonry work could be laid.

Now it is the fact that these two barriers had to be constructed across one of the greatest rivers in the world, which renders the Nile irrigation works, considered from an engineering standpoint, doubly meritorious. At Aswan, foundations had to be laid across channelways through which, in times of flood, the river rushed with a speed of 15 miles an hour, and consequently the very highest skill and resourcefulness of the hydraulic engineer had to be brought into play to devise means of stemming the great river, diverting it, and pumping dry the river bottom, before a single stone could be laid in the work of erecting the dam itself.

Yet, in spite of these difficulties, in each case the contractors completed their work twelve months within the very limited period of four and five years allotted for construction.

Now, this matter of the rapid construction of waterworks is one that will appeal very strongly to the residents of the city of New York, for the reason that they have now under construction two great waterworks which are as vital to their comfort and well-being as the Egyptian waterworks are to the dwellers in the Nile valley. We refer to the great dam, which is being built at Croton and the Jerome Park reservoir, now under construction in the northern part of this city. As compared to the Aswan dam, with its total length of a mile and a quarter, the Croton dam proper is but 1,200 feet in length, with a spillway that involves no great depth of foundations 1,000 feet in length. The maximum depth of the Croton dam from foundation to crest is, it is true, double that of the Nile dam, but this depth is only found at the center of the dam, and the depth reduces rapidly as the abutments on each side of the valley are reached. The contract for the Croton dam was signed August 31, 1892, or six years before that of the Aswan dam. The Aswan dam was completed last year, whereas the Croton dam has just had an extension of time to October 1, 1904. It is true the extension was required partly on account of important structural alterations; but even had these alterations not been made, the dam would not, in all probability, have been completed and handed over to the city for another eighteen months.

The contract for the construction of Jerome Park reservoir was signed August 23, 1895. The reservoir was to have been completed by August 23, 1902; yet the best we can hope for is that the western half of the dam will be open by the end of this year, and the eastern half twelve or eighteen months later.

Scarcely less vital to the interests of the city than a perfect supply of water, is the provision of bridge facilities for inter-borough communication, and one of the most crying necessities of the past decade has been for more bridges connecting New York with Brooklyn. Unfortunately the same exasperating delay is being experienced in the Department of Bridges as in that of Water Supply, as witness the following facts: The construction of the new East River Bridge, now known as the Williamsburg Bridge, was commenced in 1896. Considering the urgency of the situation, it should have been possible to secure the services of this bridge within five years' time, or in 1901. A reasonable despatch was shown in the construction of the foundations, and there is some excuse for the comparative slowness of the erection of the steel towers, in the fact that it was difficult to obtain steel from the manufacturers. The great delay, however, has been occasioned by the failure of the contractors for the cables, not merely to live up to their contract time, but to show even the semblance of a desire to do so.

It was arranged that the Roebling Sons Company, the contractors, upon receiving notice that the towers and abutments were completed, should immediately commence stringing the cables, and that they were to have this work completed within ten months from the date of such notice. This notice was given in December, 1900, and consequently the ten months expired in October of 1901; yet in spite of the fact that the contractors were supposed to have the material in such shape that they could push the work right through within the stipulated time, they had so far slighted this important work, upon which they well knew that the interests of the whole city of New York vitally depended, that they had only done five per cent of the work on January 1, 1902, or two months after the ten months had expired. There was a penalty of a thousand dollars a day for delay beyond the ten months included in the contract, yet this firm was able to secure from the Tammany administration, merely for the asking of it, six months' extension of time, thereby involving a loss of $150,000 to the city. This extended their time to April 21, 1902. On January 1, 1902, when the present administration came into power, the contractors had the assurance to ask for yet another six months' extension of time; and on the present Bridge Commissioner very properly taking a firm stand and asserting that he would not merely refuse another such extension, but that he would hold the bridge company strictly to the terms of the contract and exact the full penalty for delay, the contractors gave speedy proof that it was indifference and not inability that had made them neglect the stringing of the cables, by building 70 per cent of the work in the four months from the time the new administration came into power to April 21, the date on which their extension of time expired. Here we seem to have another clear proof of the fact that in the construction of municipal work, contractors seem often to imagine that the interests of the public are entirely subservient to their own, and that these public works can be finished within such time as suits the convenience of the contractor himself. If anyone doubt this, let him look to the figures. Five per cent of an important work, for which the city is in the most urgent need, completed in twelve months, and seventy per cent completed in four months under the spur of an impending penalty.

If further evidence were needed of the fact that the contractor, when he sees it is to his interest, can be just as expeditious in New York as he can on the banks of the Nile, as shown by the fact that the Rapid Transit tunnel, which is to be operated by the interests that are backing the construction of the same, is likely to be completed from nine months to a year inside the contract time.

The moral of all this is that the city, if it is to properly safeguard its interests, must see to it that heavy penalties are attached to every contract for urgently needed public work. For the citizen the lesson is that he must elect and maintain in power a municipal government that will carefully safeguard his interests by holding contracting companies absolutely to the terms of their contracts.

THE COOPER HEWITT INTERRUPTER.

Mr. Peter Cooper Hewitt has just made public a new application of the principles discovered in connection with his mercury vapor lamp and made use of in his static converter. Our readers will remember that the initial resistance offered to a flow of current at the negative terminals of his converter was reduced to a minimum when once penetrated by a current of high voltage, thus permitting the passage of a current of low potential; but was resumed again when the flow of current was interrupted. Mr. Hewitt now applies this principle to wireless telegraphy. He substitutes for the ordinary spark gap a mercury vacuum globe provided with two mercury electrodes, which are respectively connected to the terminals of the transformer. Condensers in parallel with these electrodes are connected to the primary of a step-up coil, which is connected with the ground, while the secondary is connected to the antenna. Now upon actuating the alternator, the induced current in the secondary rises rapidly from zero to a high potential. No flow, however, takes place between the mercury electrodes, as the potential is not sufficient to overcome the high resistance at the negative terminals. The condensers are in the meantime charged, so that when the potential is sufficiently high, this resistance is broken down and the condensers are suddenly discharged. The resistance is then immediately reestablished, and a second discharge prevented until the condensers have been recharged to their full capacity. A very rapid succession of discharges thus takes place, which depends upon the rapidity with which the transformer can charge and recharge the condensers. Obviously this effect can be increased by using a more powerful alternator and transformer. The advantages presented by this interrupter over the common spark gap are very great, because in the latter case the air between the terminals very rapidly disintegrates, with even as few as a hundred sparks per second, and the discharges soon fail to take place with sufficient sharpness. No deterioration can occur in the mercury vapor interrupter, because mercury is an elementary substance, and the only action of the current is to vaporize the liquid mercury, which condenses upon coming into contact with the cold walls of the globe, and flows back to the mercury terminals. Mr. Hewitt claims to have attained a frequency of one **million discharges per second, and probably a much higher figure can be reached.**

Dr. Michael I. Pupin, of Columbia University, in commenting upon this invention, says that it is the most important contribution to wireless telegraphy made since Marconi's earliest experiments, which demonstrated the practicability of sending messages a distance of over twenty miles without wires. The progress of wireless telegraphy has been checked by the lack of some device which would send powerful and persistent electrical waves. They should be powerful in order to carry to great distances, and should be persistent so as to permit perfect selective tuning. These requisites, says Dr. Pupin, are fully met by Mr. Hewitt's interrupter.

An ingenious process has lately been devised which, by the use of paraffin, furnishes a convenient smokeless fire. The arrangement, which is very simple and readily applicable to an ordinary domestic stove, consists of a metal tray for receiving an incombustible absorbent soaked in paraffin specially prepared for the purpose. The advantage of the process is that the paraffin in its preparation is freed of its explosive properties, so that no danger is attached to its use. The oil can even be poured directly on to the flames without the contents of the feeding can catching fire. The use of the oil does not produce any trace of evil odor. The absorbent used is prepared by a secret process.

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RADIUM—ITS EXTRAORDINARY PROPERTIES.

BY C. W. KANOLT.

In 1896 Prof. Henri Becquerel, of the Conservatoire des Arts et Métiers at Paris, discovered the radio-activity of uranium. He found that all compounds of uranium, as well as the metal itself, continually emit radiations, which act upon photographic plates and have a penetrating power similar to that of the X-rays. This was one of the first of a series of quite remarkable discoveries. Investigators immediately experimented with various materials with the hope that they might find other substances having the same property as uranium. Of the elements already known, thorium as well as uranium was found to be radio-active. But research has led to the discovery of three new radio-active substances, which are looked upon as new elements. These are radium, polonium, and actinium. Of these radium alone has been obtained in a pure condition, and it is the one which has been most experimented with.

Prof. Curie, of the Ecole de Physique et de Chimie Industrielles at Paris, and Madame Curie turned their attention to pitchblende, a mineral which consists largely of oxides of uranium. They found that some samples of this mineral from Bohemia possessed a greater activity than either uranium or thorium, the only substances then known to be radio-active. This fact led them to the conclusion that the activity of the pitchblende must be due to some new element of great activity. In order to find this new substance, they dissolved a quantity of pitchblende in acids and, by the ordinary chemical methods, separated the material into portions containing different elements. They then observed which of these portions possessed radio-activity. This could be done by exposing photographic plates wrapped in opaque paper to the substances and observing which plates were acted upon. But it could be done more expediently by another method. Becquerel had observed that the new radiations—"Becquerel rays" as they are now called—render the air through which they pass a conductor of electricity. They are now known to have a similar effect upon many other substances which do not ordinarily conduct electricity. The Curies had but to measure the conducting power of the air in the immediate neighborhood of the material under investigation, to find whether the material was radio-active and to obtain a measure of its activity, if it possessed any. Guided by such experiments, they gradually concentrated the active substances into small portions of the material. One portion they believed to contain a new element, which they called "polonium;" another yielded radium.

The radium greatly resembled barium chemically, and its separation from barium was the last and most difficult part of the operation. It was at length accomplished by fractional crystallizations and fractional precipitations, and in 1902 Madame Curie announced the preparation of pure radium chloride. E. Demarçay examined the spectrum of this material, and found that it consisted of lines which were not those of any previously known element, thus proving quite conclusively that the radium was actually a new element.

Something about the rarity and the cost of radium may not be without interest. According to Prof. Curie, there are not two pounds of radium in existence. In the last three years not more than one and one quarter pounds have been manufactured. Even this small quantity is of all grades of purity. Absolutely pure radium does not exist as a metal. Only its salts are known. The substance with which chemists experiment is chloride of radium associated with barium. Of the value of radium many fantastic accounts have been given. It goes without saying that so rare a substance is costly—more precious indeed than any precious stone. Prof. Curie has in his possession what is probably the only pure specimen of chemically pure radium in the world. The sample is about the size of a buckshot, weighs not quite half a grain. So many tons of pitchblende were required for the reproduction of this small amount that Prof. Curie has said it could not be bought for $20,000. Indeed such a specimen of radium has almost any commercial value its possessor chooses to give to it. A firm of manufacturing chemists of Paris furnish tiny tubes of radium of a lower grade, containing an appreciable quantity of barium, and weighing about as much as Prof. Curie's precious specimen, for $5,000. Preparations containing barium salts and small quantities of radium are on the market at the much lower price of $4.50 to $100 per gramme, the gramme being equal to 15.42 grains.

The amount of radium contained in pitchblende is so small that it must be brought to a concentration no less than five thousand times as great before it can be detected by that exceedingly delicate instrument, the spectroscope. It is needless to say that the discovery of some mineral yielding radium in greater quantities, is much to be desired. Sir William Crookes, reasoning from the facts that radium is very similar chemically to barium, and that elements of similar nature are likely to be associated in minerals, experimented with a number of specimens of barium minerals with the hope of finding radium in them; but none of them were radio-active.

Radium has never been prepared in the metallic state. The radio-activity of the pure salts is very great. Prof. Curie states that it is a million times as great as that of uranium. The radium rays will act upon a photographic plate in a few seconds, while uranium requires hours.

The radiations themselves are very interesting. They cannot be refracted, polarized, or regularly reflected, as ordinary light can be. They are quite different from light. Prof. Becquerel observed that a part of them are deflected by a magnet. This immediately reminds one of the cathode rays of a Crookes tube, which are similarly deflected. The cathode rays are now known to be nothing less than streams of most minute particles, carrying negative electricity and moving with enormous velocities. All evidence points to the deflectable portion of the Becquerel rays being quite the same thing. The Curies have shown that they also carry negative electricity; and Prof. Becquerel has shown that, like the cathode rays, they are deflected by electrostatic forces. From the results of these experiments, Prof. Becquerel has calculated the velocity of these particles. They do not all move at quite the same rate. A portion of them have a velocity of 100,000 miles per second, a velocity quite comparable with that of light, 186,000 miles per second. The cathode rays in a Crookes tube have a velocity of about two-thirds that of light.

Prof. Becquerel has also calculated the ratio of the mass of the particles to the quantity of electricity which they carry, and this too has about the same value as in the case of the cathode rays. Prof. J. J. Thomson has shown that the particles in a Crookes tube have a mass only about one-thousandth of that of a hydrogen atom, which we have always looked upon as the smallest particle of matter existing. We have reason to believe that the particles of the Becquerel rays are of the same size.

One might reasonably inquire whether radium does not rapidly lose weight as the result of the constant emission of these particles; but Prof. Becquerel has calculated that one square centimeter of radium surface would lose only 1.2 milligrammes of matter in a thousand million years. However, A. Heydweiller has recently found that radium does lose weight perceptibly. He found that 5 grammes of a material containing a small percentage of radium lost about 0.02 milligramme per day, and he observed a total loss of about ½ milligramme.

The portion of the Becquerel rays which are not deflected by a magnet, appear to consist largely of very penetrating rays resembling the X-rays; but there are also rays of a third kind, easily absorbed.

One of the most striking properties of radium is its luminosity. The pure radium chloride emits enough light to enable one to distinguish printed characters. The rays from radium excite phosphorescence in many bodies, such as zinc sulphide, diamond, and even common salt. The luminosity of radium is perhaps but the phosphorescence produced by its own rays. If a small quantity of radium is held against the forehead while the eyes are closed, one will see light. The rays penetrate to the retina, and cause it to phosphoresce.

Certain chemical changes are brought about by the rays from radium. Under their influence, oxygen is converted into ozone, yellow phosphorus into red phosphorus, glass becomes violet and almost black.

The physiological action of the rays is quite marked. If a small quantity of radium be kept near the skin for a few hours, the rays produce a serious sore. Prof. Becquerel once slipped a small quantity of radium contained in a glass tube into his vest pocket. He carried it in all about six hours. For some days no result was observed, but at length a sore developed, which required seven weeks to heal. The hands of persons working with radium are likely to be affected. The fingers become inflamed and very painful. Prof. Curie has said that he would not venture into a room containing one kilogramme of radium, as it would probably destroy his eyesight, burn off his skin, and even kill him.

E. Aschkinass and W. Caspari have exposed cultures of a species of bacteria, *Micrococcus prodigiosus*, to the rays from radium, with the result that the bacteria were killed. It was necessary to place the radium quite near to the bacteria, as the action seemed to be due to those of the rays which are easily absorbed by the air.

When any body is placed near to a radium salt exposed to the air, it becomes radio-active itself. This induced activity is only temporary, however. It disappears in the course of a few hours or days. It does not depend upon the nature of the body in which it is induced. Even the hands and clothing of the experimenter become temporarily active. The induced activity seems to be produced not by the radiations, but by a radio-active "emanation" or gas-like substance which is given off by radium and carried by the air. Exactly what this emanation is, is not known; but Prof. Rutherford and Miss Brookes have made a determination of its rate of diffusion, which indicates that its molecular weight lies between 40 and 100. F. Giesel states that a solution of radium bromide decomposes to some extent, with the liberation of bromine and the formation of radium hydroxide and other compounds; and that it also liberates a peculiar colorless gas which is radio-active. What this gas is has not yet been made known. It may be mentioned that Rutherford and Soddy have found that the emanation which is given off by thorium compounds has the chemical inertness of the gases of the argon group.

The energy of the rays from radium has been found to be quite considerable. Rutherford and McClung have estimated that a gramme of radium radiates in a year energy equivalent to 3,000 gramme-calories, which is about one foot-pound per hour, that is, the power necessary to raise a pound a foot in an hour. The source of this energy is a mystery. Several theories have been presented to account for it. Rutherford and McClung suggest that the energy is liberated by the breaking down of the atoms into smaller particles, the particles that are radiated.

Radium is not likely to find much practical use soon, although it has been made use of in a new electroscope for investigating the electrical condition of the atmosphere; but the properties of radium are very important from a theoretical standpoint, for they promise to give us much information concerning the deeper nature of matter.

Columbia University.

PROPOSED SUBWAY AND ELEVATED EXTENSION IN NEW YORK CITY.

In a report recently submitted to the Rapid Transit Commissioners, the Chief Engineer of the Commission, William Barclay Parsons, recommends that the Commission authorize the construction of a scheme of new subways, and extensions of the elevated railroad system, which will add enormously to the rapid transit facilities in this city. We give herewith a brief digest of the proposed work, and in a subsequent issue, we hope to publish plans and a more detailed description. The new subways include a two-track line from 42d Street and Broadway, south beneath Broadway to 14th Street, and thence below University Place, Worcester and Church Streets to South Ferry. A short spur will run from Broadway under 32d Street to the new Pennsylvania terminus at Seventh Avenue. Another line with three tracks would extend from the subway at 40th Street and Park Avenue, below Lexington Avenue to the Bronx. A third extension would be to carry a line from West Farms along the east side of Bronx Park to Wakefield and Mount Vernon.

During the construction of the subways, it is proposed to build the following additional elevated lines and tracks in the city: Two additional tracks on Second Avenue from the Harlem River to Chatham Square and over the Park Row line to City Hall; a third track from 59th Street to Ninth Avenue on the Third Avenue line, and a third track from south of the Harlem River to Westchester Avenue; an extension of the Sixth Avenue line along Christopher Street to Greenwich Street on the Ninth Avenue line, and the laying of a third track on the Sixth Avenue structure from Eighth Street northward; the laying of a third track from 14th Street on the Ninth Avenue line south to Cortlandt Street; the extension of the third track on the Ninth Avenue line from 116th Street north to 155th Street; the widening of the Putnam Railroad bridge across the Harlem to a three-track structure, and the extension of the Eighth Avenue line with three tracks by way of Jerome Avenue to Woodlawn, and thence to a connection with the Putnam Railroad in Van Cortlandt Park; the abolishing of the surface tracks of the New York Central Railroad below 59th Street on the west side of Manhattan, and the substitution therefor of a four-track elevated freight and passenger viaduct, which will extend by way of West Street to Battery Place. The estimated cost of these improvements, based on preliminary investigations, is from $45,000,000 to $50,000,000.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1417, offers a wide variety of instructive articles. Mr. Frank C. Perkins describes some German and English tank locomotives, illustrating his text with photographs of engines. The English correspondent of the SCIENTIFIC AMERICAN continues his discussion of London's water supply. Electrical subjects are treated in articles on "The Theory of Wehnelt Interrupters," and the "Braun Portable Wireless Telegraph Equipments in the German Army." Mr. Henry R. Lordly's valuable paper on "Anti-Friction Bearings" is concluded. Of technological interest is an article on "Improvement in Sugar-Refining During the Last Twenty-five Years." The employment of balata as a substitute for gutta-percha is exhaustively discussed in a very readable article. Mr. Fred T. Jane continues his "Naval War Game" series, the present installment being a continuation of the account of the imaginary battle between an American and a German fleet.

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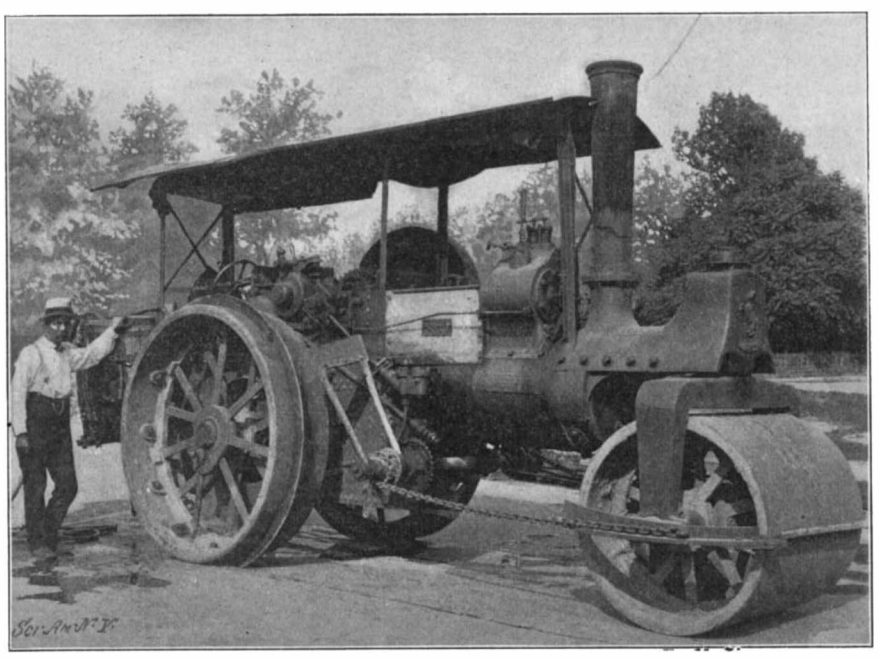
NEW METHOD FOR CUTTING ASPHALT PAVEMENT.

It is an ordinary practice, in repairing asphalt pavements, to cut through the asphalt to be removed by means of wedges or chisels. This requires two men; one to hold the wedge and the other to handle the sledge, so that the operation is slow and consequently expensive. An improvement on this primitive method is shown in the accompanying illustration. It consists in fastening cutters to the rims of the rear rollers of a steam roller. These cutters are made in two sections, so that they may be easily applied. They have an L-shaped cross section, and are secured to the rollers by fastening bolts, which project through the base portions at suitable intervals, and pass through the usual pin openings formed in the rim of a wheel. When the machine is operating, it may be necessary to apply water to the cutter. Therefore a tank is supplied on the machine at each side, and water may be fed slowly onto the cutters through spigots. In operation, when the machine is passing along the pavement, its great weight will force the cutter through the asphalt to the bed of the street. By moving the machine back and forth, the cuts may be made as close together as desired, so that with ordinary tools, blocks of asphalt may be readily broken up.



CUTTING ASPHALT WITH STEAM ROLLER.

Mr. Joseph Richards, of 840 Girard Avenue, New York city, who is the inventor of this attachment, informs us that with it he has cut as much as eighteen hundred linear feet in forty minutes when the thermometer was below freezing. Obviously this is a very cheap and simple method of doing what has heretofore been regarded as very slow, tedious, and expensive work.

THE PRODUCTION OF LOW TEMPERATURES.

It was not very long ago when the experiment of freezing mercury, as performed in physical laboratories, was considered quite remarkable. To-day, however, it is not so looked upon; and the physicists have shown us that by the judicious use of liquefied gases extremely low temperatures in the neighborhood of 200 deg. Centigrade (392 deg. Fahrenheit) below zero can be obtained without very much trouble.

If, however, theoretically, no man of science ignores the fact that such extreme intensity of cold can be produced, many, on the other hand, practically, find it materially impossible to produce them.

Contrary to what one would suppose, nevertheless, it is not extremely difficult to obtain very low temperatures with apparatus easy to procure. As Prof. d'Arsonval demonstrated recently at the Academy of Sciences, with certain judicious precautions, one can easily produce temperatures between —60 deg. C. and —195 deg. C. (—140 deg. F. and —383 deg. F.).

Thus, if some chloride of methyl be placed in a porous receptacle, by its simple and natural evaporation through the sides of the vessel, the temperature will reach 60 deg. C. below zero. With carbonic acid or acetylene, it is easy to obtain temperatures ranging from —112 deg. C. to —115 deg. C. (—233.6 deg. F. to —239 deg. F.) To do this, acetone which has been previously cooled is made to absorb carbonic acid or acetylene snow, either of which may be easily obtained at ordinary temperatures and varying pressures by opening a cylinder containing liquid carbonic acid or acetylene. The cold produced by the sudden evaporation of a part of the liquid mass, lowers the temperature sufficiently to transform the rest of this mass into a snow which, left to itself, then slowly melts. The snow is caught in a napkin, rolled up in the shape of a cone, into which the jet of carbonic acid or acetylene is directed from the cylinder containing the liquefied gas. This snow, especially that derived from acetylene, is very soluble in acetone. At —80 deg. C. (—176 deg. F.) acetone will dissolve more than 2,500 times its volume of acetylene. The snow, in dissolving, will lower the temperature 20 deg. C. further, and, if the acetone has been sufficiently cooled beforehand, this will bring the final temperature down to —115 deg. C.

The method pursued by M. d'Arsonval for obtaining by this process the lowering of the temperature to —115 deg. C. is as simple as it is ingenious. It consists in hastening the evaporation of the carbonic acid or acetylene snow, by a suitably cooled current of air. For this purpose, he makes use of a double coil of tin pipe obtained by inserting in a piece of pipe 10 millimeters in diameter and 10 meters long another pipe of the same length, but only half the diameter, and then rolling the two into a spiral, after which they are packed in a wood box stuffed with wool to prevent exterior radiation.

The upper end of the small pipe is connected to a blower and the lower end is introduced into the bottom of the solution of snow-acetone, while the upper end of the large pipe opens into the air and the lower end passes in through the stopper of the vessel containing the solution. The air that is blown in through the small pipe passes through the volatile liquid and produces very rapid evaporation—evaporation which is accompanied, naturally, by an enormous absorption of heat. As a result of this, the gases that are disengaged are at a very low temperature. But these cold gases must make their exit through the large pipe which incloses the small, thin, tin one through which the air was drawn in. Therefore the entering air is cooled economically by the gases of evaporation before it reaches the mixture of snow-acetone.

For temperatures still lower than 115 deg. C. below the melting point of ice, recourse must be had to liquid air, which can now be easily produced by the Linde process. The following is the method pursued in obtaining these intense degrees of cold that it is possible, moreover, to maintain perfectly constant.

The liquid air is placed, in order to avoid its rapid loss by evaporation when exposed to the air, in a closed vessel that is as impermeable as possible to heat—a vessel consisting, as is generally known, of a double casing of silvered glass packed in a wool lined box.

In another silvered, double walled vessel, likewise packed in a box in wool, some gasolene is placed. This liquid, if it has been made in the usual way, is capable of resisting without congealing a temperature as low as —194 deg. C. (—317.2 deg. F.), which is that of ebullition of liquid air under the normal pressure. Into this bath of ether, which constitutes the medium to be cooled and to be maintained at a constant temperature, a sort of test tube of thin copper is introduced. If the experimenter then forces liquid air through this tube and causes it to fall drop by drop into the vessel surrounding it, by the evaporation of this air he will obtain a cooling of the gasoline which may be maintained constant if the flow of liquid air is suitably regulated. For this, M. d'Arsonval uses two different arrangements which are equally simple. The first consists in employing as a reservoir for the liquid air a double walled flask closed by a cork through which two tubes pass. One of them goes to the bottom of the flask, so that its end is below the surface of the liquid air. The other, which merely passes through the stopper, terminates in a rubber bulb. By squeezing the bulb and thus exerting a pressure on the volatile liquid air in the flask, the latter is forced in small quantities through the outlet tube which leads to the small metal cup inside of the vessel containing gasoline. The apparatus is nothing more or less than an application of the pipette of the chemist.

The other arrangement, which is perhaps even more commodious, consists of a double walled glass tube terminating at the bottom in a small pipe, the flow of liquid air through which can be regulated by a vertical glass needle.

By following the above described methods of M. d'Arsonval, great intensities of cold can be obtained without using an excessive amount of liquid air. "With cylindrical silvered vessels of about a liter in capacity," says this illustrious physicist, "the loss of heat by exterior radiation at —194 deg. C. can be reduced to 20 grammes of liquid air per hour—a very small quantity, as will readily be seen, and one that will make the employment of liquid air quite practical."—Translated for the Scientific American from La Nature.

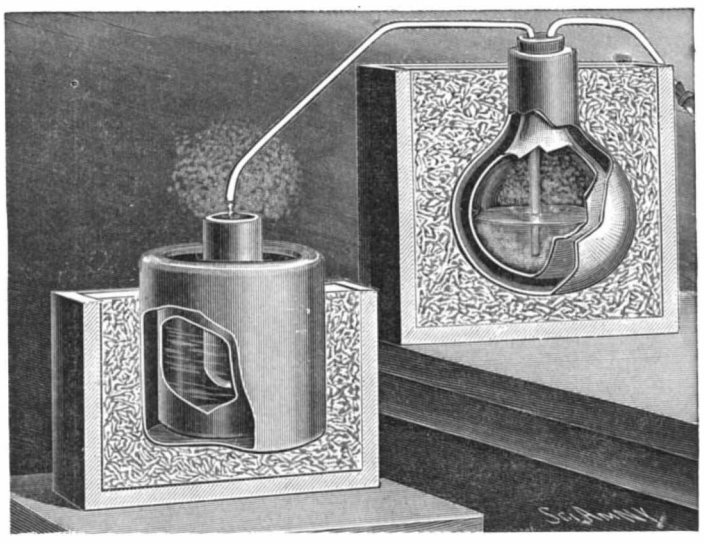


Fig. 2.—ANOTHER METHOD OF FREEZING GASOLINE BY LIQUID AIR.

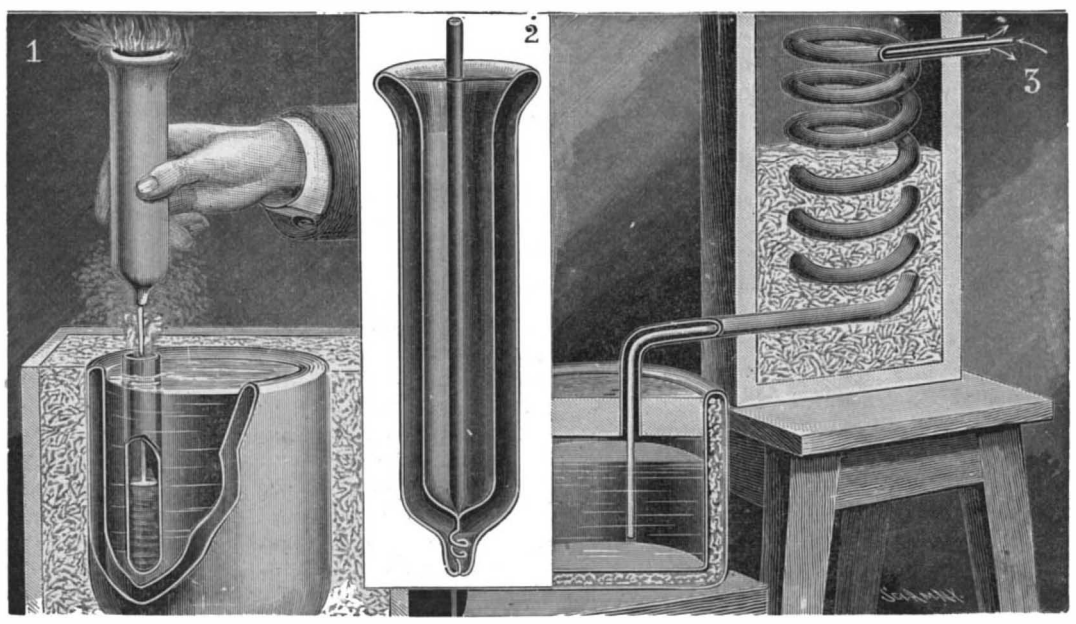


Fig. 1.—1. FREEZING GASOLINE BY LIQUID AIR. 2. TUBE OF LIQUID AIR. 3. APPARATUS FOR VOLATILIZING CARBONIC ACID DISSOLVED IN ACETONE.

Several very interesting experiments in fruit and vegetable drying have been carried out at Northingtown Farm, Worcester, England, with the new apparatus which has proved so successful for hop drying. The invention consists in drawing the hot air into a grid-work of steam pipes, through which air passes into the chamber beneath a "slotted" floor, on which the hops are placed. This method of heating the air prevents the assimilation of sulphurous gases by the products treated, and makes burning impossible. Samples of carrots, potatoes, sliced and shredded apples, and other fruits and vegetables were submitted to temperatures ranging from 90 deg. to 140 deg. After six hours all were in the state of dryness required for commercial purposes. The cost of working the system is trifling, and it is expected that a new agricultural industry will soon be opened in which English fruit-growers may successfully compete with the Germans, who now export about $700,000 worth of dried fruit and vegetables annually to Great Britain.

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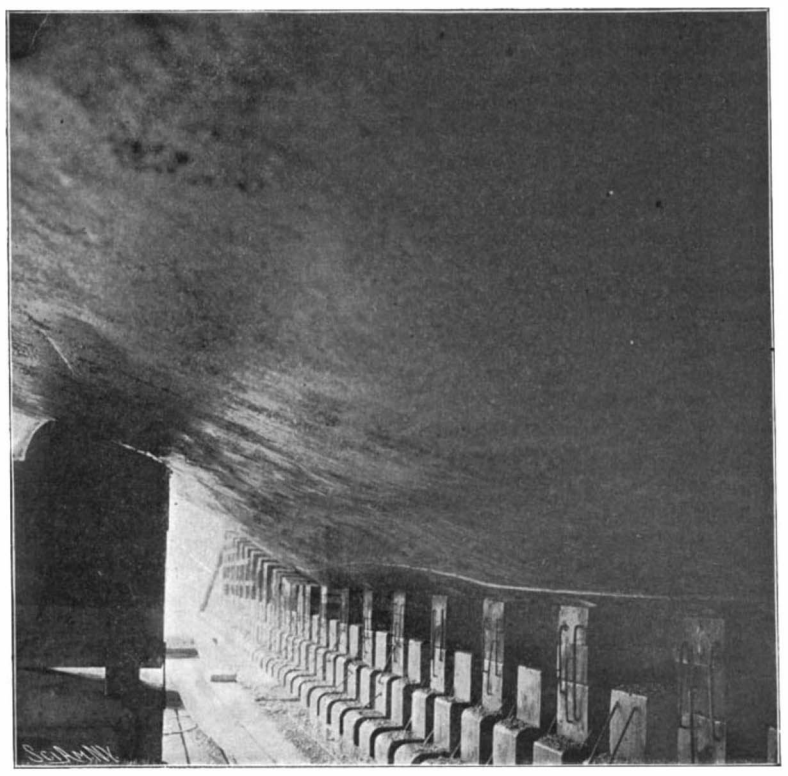
THE INJURED HULL OF THE UNITED STATES CRUISER "BROOKLYN."

It was not until the cruiser "Brooklyn" was dry-docked in the Brooklyn navy yard that the extent of the injuries to her hull was fully disclosed. The accident occurred on September 3 last, as she was withdrawing from the maneuver against Fort Rodman in Buzzard's Bay, Mass., when she ran upon an uncharted sunken rock or wreck, while under the command of Rear Admiral Joseph Coghlan. The illustrations, from photographs by Mr. E. Muller, show the appearance of the bottom of the hull after the accident, looking like a general wavy indentation as viewed underneath toward the stern near the keel, and also the peculiar twisting of the transverse and longitudinal framing located between the inner and outer plating after the outside plates had been removed.

Admiral Coghlan found that six frames under A 98 and A 99 were bent inward, and the inner bottom plates of the inner hull were bulged; also the frames under No. 1 fireroom, port side, were bent inward from six inches at frame 35 to nothing at frame 59. Only a small leakage of water occurred at frame 37. The accident was not serious enough to prevent the cruiser from proceeding under her own steam to the Brooklyn navy yard.

The accident gives further proof of the superiority of these steel framed and built vessels over those of wood construction by their capability of withstanding severe strains without serious damage. The bent beams have been straightened, the outside plates replaced, and the cruiser put into commission again.



THE DAMAGED HULL OF THE U. S. CRUISER "BROOKLYN."

Why and How Fishes Leap.

BY CHARLES F. HOLDER.

The observant stroller by lake or seashore, or he who goes down to the sea in ships is often entertained by the aerial performances of fishes; acts which, because they are seemingly unnatural, invariably attract attention and often occasion widespread wonder. Nearly all of the fishes are jumpers, that is, those which habitually live in the upper regions of the ocean, or at the surface, as the gars, flying fishes and others. The motives for jumping are manifold: First, for pleasure, or in the pursuit of some game; second, in sudden fear or panic; and third, to escape an enemy; fourth, to secure or capture prey; and fifth, to secure satisfactory prey. In these classes may be included nearly all of the well-known leapers of the finny tribes, among the legions of the ocean.

Once while lying quietly on the wall of an inclosed aquarium on the Florida reef, I saw a number of garfishes—the long, slender, needlelike fishes so familiar in Southern waters—leaping over the back of a small hawksbill turtle which was floating on the surface of the inclosure, fast asleep and innocent of the purpose to which it was being put. The animal's back was probably eight inches across, and the fishes cleared it several times with ease. I also observed small sardines leap over a floating twig. These instances illustrate the fact that fishes have games, and jump in the sense of children over some obstacle; in a word, perform acts which are entirely unexplainable under any other motive. That all whales, and especially large whales, indulge in games is believed by every sailor. Some lie on the surface and fan the air, beating the water terrific blows, evidently for amusement. Others make remarkable leaps. I once saw a California gray whale, estimated at between sixty and seventy feet in length, assume a most remarkable position. The huge animal came out of the water slowly, its head rising upward apparently by continued manipulations of the tail until it fairly stood up on this organ, a mighty black column in midair; then instead of falling with a terrific crash, as might have been expected, the whale sank back seemingly holding the perpendicular. A little more effort would have sent the great creature clear of the water. Such a leap was observed by the crew of the ship "Leander" in the harbor of Bermuda. The whale leaped into the air and nearly passed over the boat, clearing it by twenty feet, the men seeing the colossal animal poised over their heads.

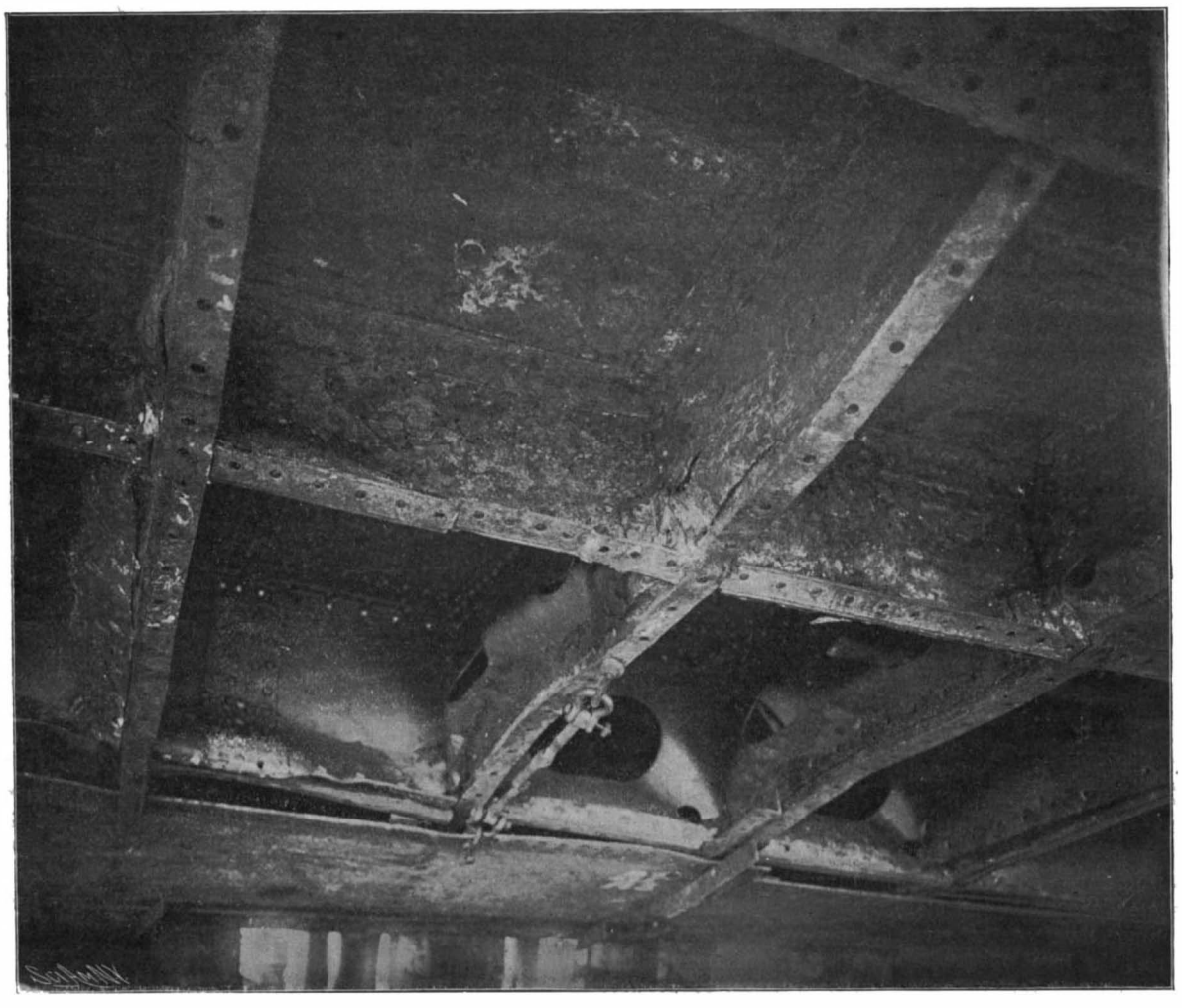
During a recent trip to the great inland lagoon which is formed along the coast of Texas by the offshore sand dunes or islands, I witnessed many instances of high jumping among fishes. Perhaps the most remarkable was a shark which hurled itself into the air and then underwent an interesting contortion, a violent swing of the tail in lateral motion. This fish was hooked, and its efforts were directed toward removing the hook. The shark is one of the clumsiest of all marine animals, owing to its bulk, and is naturally lethargic, so a leap high in air may be considered an unusual feat. I have seen the so-called oil shark of Catalina Harbor leap into the air. Whether these fishes would leap if the water was shallow is a question open to discussion. The Texas shark referred to was in water twenty feet in depth, and the Catalina specimen in water barely four feet deep.

After many observations I believe the natural inclination of the majority of fishes is to plunge downward when hooked. The whale sounds when struck, but in shallow water this is impossible, and the animal in desperation dashes upward into the air in its efforts to escape. I think this is one reason for the marvelous leaps of the tarpon; and in a number of observations made with the tarpon near the boat, I saw a quick rush down, followed immediately by an upward rush into the air. The fishes were hooked in shallow water, not over fifteen feet in depth, hence sounding was impossible, and nearly all tarpon are caught in the shallows. The leap of this fish—the king of jumpers—is sensational in the extreme. The tail is the motive power, and propelled by it the fish either dashes head first into the air or rises bodily. In the latter instance the leap is not high, but in the former it may be ten, even fifteen feet. The leap is the result of fear or frenzy, and the moment the fish clears the water it swings itself from side to side, with wide-open mouth and gills, presenting a singular appearance. The force of the lateral swings is often sufficient to dislocate the vertebral column entirely or partly. Such swings have been known to hurl a hook fifty feet at a boat with sufficient force to penetrate a hard oar. In some of the leaps I forced, the fish must have turned a somersault, or thrown themselves upon their heads, tail up, into the air. The tarpon will also leap when chased by sharks—their natural enemy—making marvelous bounds.

The lagoon or bay referred to, in Texas, being very shallow, was a remarkable locality in which to observe the leaping of fishes. The mullets led the van, leaping everywhere and incessantly, evidently in play, as there were no enemies to follow them; and while watching them at one anchorage three other fishes jumped into the boat—a pompano, a "ten-pounder" and one other. The pompano gave a fine exhibition of a long leap, covering probably twenty feet, the latter part being made with its side parallel to the water; so the fish shot through the air, supported by its flat surface, as a flying fish. In every leap observed the fish seemed to deliberately turn in this way, which certainly was a great aid in its flight. In the locality where these leaps were made the water was very shallow, and the only enemy, the redfish or channel bass, too small to attack them; hence I conceive the leaps to have been made in play, virtually a pastime.

The pompano is famous for its jumps. I saw these fishes take virtual flights, turning in the air in the method described. The leap is the result of a violent swinging or screwlike motion of the tail, which forces the fish out of the water in a long graceful leap; and when eight or ten feet was covered in a vertical position—the natural pose of the fish—it turned and covered the remaining distance upon its side, offering its broad surface, which must have aided in supporting it, thus increasing the distance of the leap. That this turn in midair, offering its broad side to the air, may have been accidental is an open question; yet in every leap it was observed, and doubtless was the result of an effort on the part of the pompano to increase its leap.

The most remarkable leaper of this Texan lagoon was the so-called "ten-pounder," a cousin of the tarpon, which leaped for pleasure, frequently coming into boats; jumping like a harlequin when hooked, giving the most extraordinary display of lofty tumbling to be conceived. I also repeatedly observed the jump of the calico fish, one of the rays, which as it left the water presented a remarkable appearance, birdlike in many respects. The fish rose seemingly vertically into the air to a height of at least three feet, then flapping its side or pectoral winglike fins, appeared to move along by their aid, but the motion was entirely due to the rapid and vigorous movements of the lateral fins in the water. The ray as it



THE OUTSIDE PLATING OF THE U. S. CRUISER "BROOKLYN" REMOVED, SHOWING THE DAMAGED FRAMES.

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poised looked like some strange bird, then dropped heavily back into the water. Many of the rays are jumpers of more than ordinary ability, and the leap of the largest of the family—the huge manta—observed is an extraordinary spectacle. Long before I witnessed it I had heard the crash of the return of the five or six-ton body which comes on the still night like the discharge of cannon. This was on the outer Florida reef in a shallow lagoon, and as it was infested with sharks at night, I believed that the rays were attacked and were attempting to escape.

One of the most beautiful of all jumpers of the sea is the horse mackerel, or tuna. In the Atlantic the leaps of this fish are rarely seen; but in the waters of the Pacific, particularly about the island of Santa Catalina, they are of daily occurrence at certain seasons, affording a remarkable spectacle. The tuna leaps to capture the agile California flying fish, which bounds into the air, and that the big fish sometimes secures its prey like a hawk in midair there can be little doubt. Its leap is the personification of grace; rising to a distance of eight to ten feet, it turns and plunges downward like an arrow, having preserved the perfect lines of the curve. The antipodes of this is the leap of the swordfish, which I have frequently observed.

THE CONSTRUCTION OF THE ASYUT DAM; NILE IRRIGATION WORKS.

BY OUR LONDON CORRESPONDENT, FROM NOTES BY SIR BENJAMIN BAKER, ENGINEER OF THE WORKS.

In the SCIENTIFIC AMERICAN for September 20 of last year, we published an exhaustive description of the remarkable irrigation works and barrage at Aswan on the River Nile, which on December 10, 1902, were officially opened, and handed over to the Egyptian government. But the dam at Aswan only comprises one section of these stupendous engineering works. There is another similar barrage of huge dimensions at Asyut, some 350 miles above Aswan nearer Cairo, and of greater importance, from one point of view, since the water level at Asyut influences the water level of the great Ibrahimiyah canal and other important irrigation waterways in Upper Egypt. The Ibrahimiyah canal passes through a large tract of arable land and joins the Nile at Asyut, just immediately behind the barrage that has been built across the river at this point. In fact, the object of this dam may be most succinctly described as to back up the water and thus divert it into the canals and irrigation channels traversing the existing cultivable area of Middle Egypt, right up to the borders of the desert.

The structure built at Asyut differs in design from that erected at Aswan, having, as a matter of fact, a close resemblance to the barrage built by French engineers at the delta several years ago. It consists of an open weir of 111 bays, which has a total length of 2,750 feet from bank to bank.

The openings are each of 16 feet 4 inches span, and are each supplied with steel sluice gates 16 feet in height. At every ninth opening is built an abutment pier 13 feet in thickness, the intermediate piers being 7 feet, 6 inches thick. The piers are spanned by arches, and carry a roadway, 14 feet, 9 inches wide, at a height of 41 feet above the floor of the structure. This roadway not only affords communication between the opposite banks but, as will be seen from our illustration, carries the winches and suspension apparatus for regulating the sluice gates, which controlling machinery is placed on a trolley traveling along a railroad.

Great difficulty was experienced in the preparation of the foundations for the structure, and the cost of this part of the work greatly exceeded the estimate prepared in accordance with the engineers' surveys.

The general scheme of the foundation consists of a solid platform of masonry, 87 feet in width by 10 feet in thickness, extending from bank to bank and laid throughout at one level. This solid platform is in turn protected up and down stream by a continuous and impenetrable line of grooved and tongued cast-iron, sheet piles, which are driven into the sand bed of the river, extending 13 feet below the bottom of the masonry foundations. This protective iron piling, the joints of which are cemented, prevents the water filtering beneath the masonry foundations, thus preventing any undermining or scouring action, which would impair the rigidity and safety of the structure. Provision is still further taken to prevent the erosion of the river bed in the vicinity of the barrage by stone pitching with clay puddle, which prevents infiltration for a distance of 67 feet upstream, and on the opposite side for a similar distance, stone pitching with an "inverted" filter bed.

During the season of 1899, while the river was at low level, work was commenced upon the western side, and the foundations of the navigation lock and 29 sluice openings were completed, the walls and piers being built up above the summer level of the river. In the ensuing season (1900), as the level of the Nile was abnormally low, work was pushed forward with all possible speed, in order to get the foundations completed. The months of May and June of this year were the busiest during the erection of the entire work. During these two months no less than 13,000 men were employed every day. Even Pharaoh himself could not have crowded more Israelites upon such a confined area than did the contractors at this point; but so methodically was the work apportioned, that there was not the slightest confusion. The attempt to complete the whole of the foundations during the 1900 season proved almost successful. The *modus operandi* of the builders was to inclose the area, upon which it was intended to work during the season, by temporary dams or "sadds" in November, then to pump the water from the inclosure, and, keeping it down by means of centrifugal pumps, push forward with the work so as to build it above summer level; then, when the river was in flood, the force of the water swept away the sadds. In 1900 the whole of the foundations would doubtless have been completed, but for the fact that on July 23 the Nile suddenly rose, and made a breach in the sadds, which could not be repaired, so that 65 feet of the masonry floor remained unbuilt, and a further length of 459 feet was only partially completed. Regrettable though the accident was, it could not be rectified, so that work on this section had to be abandoned till the following year. In the short time building operations had been in progress, however, the navigation lock, with the exception of fixing the gates and the swing bridge, was practically finished, while 27 piers had been carried up to their full height, 43 to three-quarters of their height, 19 others to above the summer level of the river, and but the last 19 piers had not been commenced.

The foundation work left for completion in the 1901 season was the section between the middle of the river and the east bank. It was only a short length, it is true, but nevertheless it constituted the most difficult part of the whole undertaking, and considerably more money had to be expended upon this portion than had been anticipated.

The construction of the necessary sadds to inclose the site was commenced on January 28. Even this task in itself was of no small magnitude, for the first inclosure, near the middle of the river, covered no less than 6¾ acres. The centrifugal pumps to remove the water from this sadded area were set at work on March 4, and then the troubles began. The sadd at the eastern end of the site was leaky and unsafe, and it was found impossible to pump out the water for fear of a subsidence of the temporary embankment. Smaller dams were therefore hastily built within the main sadd, inclosing about three acres, and the water was removed from this sufficiently to allow the builders to continue the construction of 13 of the piers that had been commenced the previous season, and also a portion of the adjacent masonry flooring.

It was then attempted to complete the masonry platform on the river bed in the center of the river, but this was found to be a most difficult task. The water within the sadd could not be pumped out, since immediately the level of the water within the inclosure was lowered beneath that of the Nile, the embankments threatened to give way. Springs were encountered in every direction, and it was found absolutely impossible to render the present sadd absolutely watertight. The engineers then set to work to build the sadds right across the river and to connect them with the eastern bank. This in itself was a gigantic undertaking, since by this operation the main channel of the river was completely diverted. The total sadded areas reached nearly half the width of the river, and extended over approximately 13¼ acres. A comprehensive idea of the labor involved in these preliminary operations may be gathered from the fact that in one season 1,500,000 sandbags were employed in the construction of these temporary embankments. Fifteen 12-inch and several smaller centrifugal pumps were utilized to remove the water from within the sadds. The pumps had to be kept continually at work, and a watchful eye maintained upon the sadds, as powerful springs continually burst forth through the sandy river bed, which, if they had not been checked, would have threatened the safety of the workmen and structure. During this season no less than 284 of these springs had to be dealt with, while during the whole of the building operations, 974 springs received attention. By May 10, 1901, a determined start had been made once more upon the uncompleted foundations, and the section of the masonry platform so far untouched was commenced. A month later the last stone in the foundation was laid, and the construction of the twelve remaining piers was proceeded with apace. By the end of June they had all been continued to above the mean river level. To guard against the evil influences of springs which might subsequently break through, and to insure that no voids existed beneath the last constructed portion of the masonry floor, holes were drilled into the river bed, at intervals of 10 and 13 feet, and cement grout forced down through pipes standing up to 16 feet above floor level. That this precaution was wise, subsequent inspection proved, for a long length of the floor previously built on the east side was found to be extensively undermined by springs, and this section of the foundation had to be carefully grouted before much excavation could be carried out, causing unfortunate delay.

These constantly-repeating obstacles afford a graphic idea of the many engineering difficulties that had to be surmounted, and the infinite care and vigilance that had to be exercised, to see that the work was carried out thoroughly.

While the last part of the foundations was being completed, work was in progress upon those piers which had been continued to the summer level during previous seasons. The openings were finished to the arch level, and the arches and parapets were then proceeded with. Practically the whole of the superstructure work was completed by the end of 1901, and the sluices were shortly afterward lowered to maintain a sufficient level over the raised sill of the lock, so that navigation might be rendered possible without any hindrance whatever. The gates of the lock were fitted before the Nile rose in flood, and in fact this part of the work was finished ready for use, with the exception of the swing bridge.

The whole of the foundations of the barrage is built of Isawiyah stone, laid in cement mortar, while the superstructure is of the same stone laid in homra and lime mortar.

As the object of the Asyut barrage is to throw a higher level of water into the Ibrahimiyah canal, and as the latter enters the Nile just south of the dam, a new regulator and lock has been rendered necessary at the head of the canal, to control the supply entering therein, especially in years of high flood, and to insure the safety of its works in case of an accident. The work comprises a regulator pierced with nine openings each 16.4 feet wide, and a lock 27.8 feet wide. The regulator is made by means of two gates, one upper and one lower, each 11.5 feet in height. The design of the foundations is practically identical with that of the barrage, and is likewise constructed of Isawiyah stone, with a similar superstructure. The method of construction was also the same, sadds being made around the site to enable the foundations to be laid.

One of the most remarkable features of this enormous undertaking was the changing of the channel of the river to facilitate work. For some years previous, the main channel of the river had been on the east bank, while on the western bank a large shoal had been gradually built, though it was pierced by a narrow channel giving access to the Ibrahimiyah canal. This passage had to be constantly dredged, otherwise the entrance to the waterway would have been filled up. For the first two seasons' work upon the Asyut barrage, this condition of the river favored the engineers, and enabled the foundations to be built quickly, but after the masonry flooring had been laid and the piers built, a different state of affairs was presented. On the western flank of the barrage, the navigation lock had been constructed—on the side where the shoal was—while the main channel of the river was on the opposite bank. The engineers now had to divert this channel to the western bank. This was accomplished as follows: The upstream temporary sadds, extending from the east bank to the middle of the river, were protected with vast quantities of rubble stone, so as to present an obstacle to the flow of the river when it again rose in flood, and thus force it to make another main channel on the opposite side of the river, where the navigation lock was situated. This scheme proved entirely successful, and with but little expense the channel of the river has been completely diverted.

The sluice gates, which are of steel, when lowered in position have a holding capacity varying from 7 feet, 9 inches to 9 feet, 4 inches of water during the summer months, and the water thus stored up will be sufficient to bring an additional 300,000 acres under irrigation and agriculture.

One noteworthy feature of this undertaking is that, owing to the high pressure with which all the work was carried out by the well-known contractors, Sir John Aird & Co., Ltd., of London, the undertaking has been completed and handed over to the Egyptian government in thorough working order more than twelve months under the originally contracted time, an achievement upon which the builders are to be highly congratulated, considering the magnitude of the task.

While engaged in unloading shells for the purpose of refilling them with smokeless power, three men were blown to pieces and four fatally wounded in an explosion, in Fort Lafayette, New York Harbor, the 19th instant. Whether the explosion was the result of carelessness or of a combination of circumstances that was unknowingly brought about by the workmen, will probably never be known. The explosion was one of those inevitable accidents that even the greatest care will often prove of no avail in avoiding.

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THE HEAVENS IN MARCH.

BY HENRY NORRIS RUSSELL, PH.D.

The finest constellations now visible are in the western sky. At 9 P. M. on March 15 Orion, the most brilliant of all, is well down in the southwest. Taurus, with the Pleiades and Aldebaran, is to the right of Orion, and Canis Major with Sirius on the left. Canis Minor is above the latter, and Gemini is still higher, almost overhead. Auriga and Perseus are northwest of the zenith, in the Milky Way.

The eastern sky has few groups comparable with these in brightness. Leo is well up in the southeast, two hours from the meridian, and Virgo follows him, her brightest star, Spica, having just risen. Hydra occupies most of the space to the south of these. But the most conspicuous objects in the eastern sky are the ruddy Arcturus, and, still brighter and still redder, the planet Mars.

Ursa Major is above and to the right of the Pole, Draco lower down, and Cassiopeia below on the left.

THE PLANETS.

Mercury is morning star throughout March, but is not well placed for observation, being south of the sun, and rising little more than an hour before him. On the 18th he is in conjunction with Jupiter, passing south of the latter at a distance of 1½ deg. With his brighter neighbor to point him out, he may perhaps be seen low in the southeast about forty minutes before sunrise.

Venus, being on the opposite side of the sun, and north of him, is well placed for observation. On the 1st she sets at about 7:30 P. M., and thereafter she is visible a little longer every night, till at the end of the month she remains in sight until 8:30. She is gradually growing brighter, though as yet she is not nearly as conspicuous as she will be in May. Mars comes to opposition on the 29th, and is visible all night long. He is in Virgo not far from Spica on line toward Regulus, and is moving slowly westward, in the direction of the latter star.

This present opposition is however an unfavorable one, as Mars is in the part of his orbit which is farthest from the sun and is 59,000,000 miles distant from the earth, as against 49,000,000 at the average opposition, and 35,000,000 at the most favorable. On these latter occasions he is more than three times as bright as at present, and is an exceedingly striking object. The next such favorable opposition comes in 1909. But even in his present diminished splendor, Mars is now the chief adornment of the midnight skies, surpassing in brightness all the fixed stars except Sirius. The most conspicuous markings on his surface are visible with small telescopes, but the study of the finer details demands the highest optical power. Though he will undoubtedly be carefully observed at this opposition, as usual, he is so far off that it is hardly probable that much that is new will be discovered concerning him. It is to be regretted that his satellites are only visible in the largest telescopes, as they are among the most interesting bodies in the solar system. They are the smallest bodies so far known to astronomy. Their diameters cannot be directly measured, but by comparing their brightness with that of the planet, it is calculated that they are about five and seven miles in diameter, the outer one being the smaller. Their orbits are much the smallest known. The outer satellite, Deimas, revolves at a distance of 14,600 miles from the center of Mars, while the inner one, Phobos, is but 5,800 miles from the center of the planet, and only 3,700 from his surface. Their periods are also very short, that of Phobos being the shortest of all the bodies of our system—7 hours 39 minutes. The apparent motions of these bodies, as seen from the planet's surface, are remarkable.

The period of rotation of Mars is 24 hours 37 minutes. That of Phobos is less than one-third as long, so that for an observer on the planets' surface it would seem to move eastward among the stars three times as fast as they were carried westward by the diurnal motion. It would consequently rise in the west, and set in the east, making rather more than two complete circuits of the heavens in a day.

The period of Deimas is longer that the Martian day, so that it rises in the east like other bodies. But as its orbital motion compensates for more than four-fifths of the diurnal motion, it rises only at intervals of five days. Both satellites are conspicuous objects as seen from the planet. Phobos must appear to be about one-fifth the diameter of our own moon, so that its phases would be visible to the unaided human eye, could we get into a position to see them. Deimas would be almost as bright as Venus, but its phases could not be detected without instrumental aid.

Jupiter is morning star in Aquarius, rising at about 4:40 A. M. at the end of the month.

Saturn is morning star in Capricornus, and rises about an hour and a half earlier than Jupiter.

Uranus is morning star in Ophiucus. On the 16th he is in quadrature with the sun, and is due south at 6 A. M.

Neptune is in Gemini, and is in quadrature on the 22d, being on the meridian at 6 P. M.

THE MOON.

First quarter occurs at 2 P. M. on the 6th, full moon at 7 A. M. on the 13th, last quarter at 9 P. M. on the 20th, and new moon at 8 P. M. on the 28th. The moon is nearest us on the 10th, and farthest off on the 22d. She is in conjunction with Neptune on the 7th, Mars on the 14th, Uranus on the 20th, Saturn on the 24th, Jupiter on the 26th, Mercury on the 27th, and Venus on the 30th. On the evening of the 8th she occults the fourth magnitude star λ Geminorum, the disappearance, as seen from Washington, taking place at 7:54 P. M. and the reappearance at 9:13.

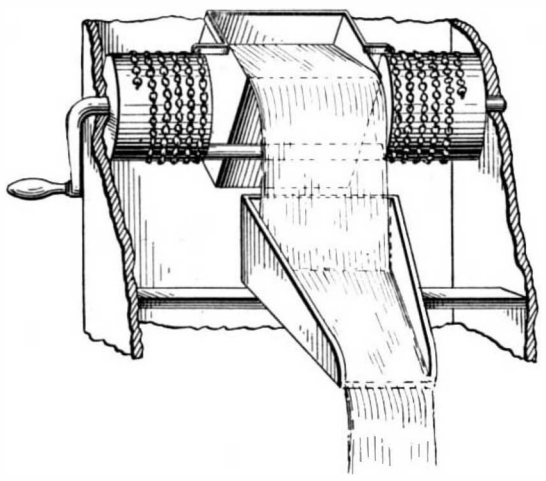
On March 28 there is an annular eclipse of the sun, invisible in North America except in Alaska, where a large partial eclipse may be seen shortly before sunset. The annular phase is visible in parts of eastern Siberia and Mongolia, and the partial phases throughout the eastern half of Asia.

Cambridge, England.

TRIPPING HOIST FOR WELL BUCKETS.

BY REV. LEWIS BOND.

It has been my privilege to reside for a score of years in the picturesque city of Monastir, which lies at the foot of the Pindus range of the Alps. The city is 2,000 feet above sea level, and a near mountain



CONSTRUCTION OF THE TRIPPING HOIST.

peak, which the Turks call the Dove, has an altitude of nearly 8,000 feet. Near the summit of this bold mountain banks of snow are ever in evidence, while a bit lower down there is a small crystal lake. Naturally, the water supply for Monastir is abundant and cool. The wealthy citizens indulge in private fountains, but the common people drink from wells.

The staple pump of this region is very crude. The affair is simplicity itself. The valves are made of cheap leather tacked to their places in very rude fashion. The upper valve is a cornucopia fastened to lower end of piston rod. The chief advantage—to the

CONVENIENT TYPE OF WELL IN MACEDONIA.

trade—of this style of pump is the facility with which the concern gets out of repair, and this accounts for the well curb in my door yard. It is nearly as simple as the native pump, but vastly more effective, more enduring, and much more easily operated.

The construction is as follows: At either end of the iron axle there is a wooden cylinder, 7 inches long and 8 inches in diameter. The space between the cylinders is 15 inches. The axle is bent at right angles, so as to bridge over this space; an incision being made for it in the end of each cylinder, thus leaving the space free for manipulation of the bucket. The bucket is about 10 inches square, and holds over four gallons. It may be made of galvanized iron, though in this land of limitations I find tin quite serviceable. The handle is an iron rod fastened to the top of the bucket, bent forward at the upper edge on each side four inches and then turned out at right angles, projecting on either side five inches. The bucket is suspended from the winding cylinder by chains connected to the projecting ends of the handle. It will need a little weighting on the front side at the bottom. If all is properly adjusted, the bucket when lowered into the well will fill immediately, and on drawing it to the top the iron axle comes around under the front side of the bucket and tips it so that the water rushes out into the broad trough. A bit of chain is allowed to dangle from the ends of the bucket handle to act as drags in starting back the empty bucket when needed. A light brake controls descent. As careless servants may bring up the load with a slam, I have a small alarm bell which gives warning one turn before the final tip-over.

The machine has been in operation seven years. It may not be superior to all others, but it pleases my household immensely, and "astonishes the natives."

The Origin of the Modern Steel Frame Building.

The principle upon which the steel frame construction of buildings is based has been illustrated in single places, here and there, even in ancient times. The modern idea then is not the fundamental principle itself, but its application to building construction in such a way as to develop a type of structure, in which shall be embodied the principle of carrying all the weight of a building on a frame.

There is a bronze tablet on the Tower building, facing lower Broadway, claiming that it is the first building in which the construction embodies this principle. It states that the building was erected in the years 1888 and 1889. The statement it contains, that this is the first building of this sort, is not correct; but the statement would hardly have been made by men so prominent in building interests if it were not at least the first building in New York city to have embodied the principle of steel frame construction sufficiently to have warranted its classification as a building of that character.

Other buildings in New York about that time, particularly some erected by George B. Post, also contained portions of walls carried on steel columns, and other features closely allied to the general character of the construction of steel frame buildings; but the credit of developing this idea to constitute a class of structures by itself, and to be so recognized by architects and builders, belongs, without question, to the city of Chicago.

The Home Insurance building was erected in 1883, and the front walls, as well as the floors, are carried on columns.

The Tacoma building was erected in 1888 and 1889, at the same time that the Tower building was erected in New York. This building was designed by Holabird & Roach. The street walls and the floors of this building were also carried on columns.

The Rand-McNally building was built in 1889 and 1890. It was designed by Barnum and Root, and was the first building in the world to be built with steel columns. Many millions of dollars were spent in buildings of this particular type in Chicago during the next two years, so that in the World's Fair time in 1893, the great buildings of the city were one of the greatest attractions to outsiders.

At this time nothing at all had been done in New York to develop the steel frame building as a particular type of construction.

History will give to Mr. Jenney the largest measure of credit in this development, but D. H. Burnham, Holabird and Roach, and George A. Fuller share the honor with him in almost equal degree in creating and maintaining the idea that buildings could be built in this way profitably. The idea that this principle could be developed into a type of construction peculiar to itself belonged to the architects named and to George A. Fuller, more, probably, than to any other men.

German Prize Offer.

The Association of Thomas Phosphate Manufacturers (No. 4 Hafenplatz, Berlin), offers the following money awards for the best essays on researches in regard to enhancing the fruitfulness of the soil by means of the activity of bacteria and other micro-organisms: First prize, 15,000 marks; second prize, 10,000 marks; third and fourth prizes, 6,000 and 4,000 marks, respectively.

In addition, the prize jury will dispose of 5,000 marks in awards for valuable scientific and practical results which may be submitted by farmers or scientists.

The essays or descriptions sent in must be written in the German language.

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VENOMOUS SERPENTS.—III.

BY RANDOLPH I. GEARE.

The Banded Rattlesnake was very naturally named *Crotalus horridus* by the great naturalist Linnæus. It occurs in rocky places on dry soil, and in North America its range extends as far north as the middle of New England and New York State, west as far as the Rocky Mountains, and south to the Gulf States. In recent years they have been comparatively scarce in many localities, owing to the advance of cultivation. About sixty years ago they were abundant in New York State, as evidenced by De Kay, who in 1842 wrote: "Two men in three days killed 1,104 rattlesnakes on the east side of Tongue Mountain, in the town of Bolton. Some of them were very large, carrying from fifteen to twenty rattles. They were killed for their oil, or grease, which is said to be very valuable." It seems somewhat strange that they are not recorded as occurring in the Adirondacks, but doubtless the summer visitors to the delightful resorts in that region are not overwhelmed with grief on that account.

In Illinois they seem to be multiplying greatly, for whereas in bygone days the pigs roamed around at will—in the absence of any stock laws—and exterminated the snakes to a large extent, now the hogs are penned up, giving the snakes their innings. West of the Mississippi, Banded Rattlesnakes are still found in eastern Iowa, Kansas, Missouri, Arkansas, and the Indian Territory.

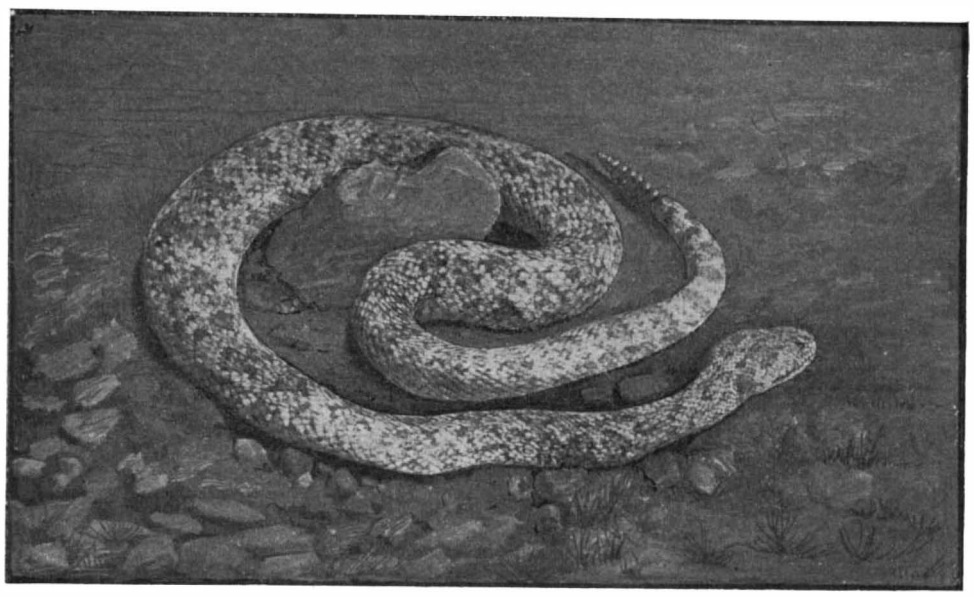
The food of the Banded Rattlesnake consists of the smaller kinds of warm-blooded animals, such as rabbits, squirrels, rats, mice, and sometimes birds. Holbrook describes this reptile as remarkably slow and sluggish, lying quietly in wait for his prey, and never wantonly attacking or destroying animals, except as food, unless disturbed by them. But when irritated or interfered with, his whole attitude changes with the rapidity of lightning. He immediately coils himself, shakes his rattles violently, and strikes at whatever comes within reach. "In his native woods," continues Holbrook, "one may pass unmolested within a few feet of him. Though aware of the presence of some one, the snake either lies quiet, or glides away to a more retired spot." It is said that this species never follows the object of his rage, be it an animal that has chanced to pass close to him, or only a stick thrust at him to provoke his wrath. He simply strikes, and prepares to strike again, or he may slowly retreat like an unconquered enemy, sure of his strength, but not choosing further combat. So apathetic indeed do these snakes become, that persons have been known to step over them without arousing their anger or causing them to coil and strike. Indeed, Dr. Stejneger, in speaking on this point in his "Poisonous Snakes of North America," says: "There even seems to be truth in some of the stories about children having been found playing with them and carrying about live rattlesnakes without having been hurt."

On this topic Dr. A. K. Fisher, of the Department of Agriculture, who has explored extensively in the West, assures me that he regards the rattlesnake as a quiet, rest-loving reptile, only attacking when attacked, and much preferring peace to battle.

The Vipers, which form a separate and rather numerous family of poisonous serpents, and which are not found in North America, will now be referred to. They are distinguished by the absence of the "pit" between the nostrils and the eyes, and they also have no teeth in the upper jaw except the two poison fangs.

One of the most dreaded snakes of this family is the Tic-Polonga or Katuka (*Daboia elegans*). It is a native of Asia, and is common in India and Ceylon. The word "Tic" means "spotted," while "Polonga" is a kind of generic name given by the natives to many serpents, no less than eight species being included. Its general color is brown, and there are two dark spots on each side of the back of the head, with a yellow streak between them. On the body are three rows of oblong brown spots, edged with white. This snake has a mortal hatred of the Cobra, which it attacks apparently without cause. There are many native legends in Ceylon regarding the ferocity of this snake.

Closely allied to the Tic-Polonga is the terrible Puff Adder, a native of South Africa, and one of the most deadly of poisonous snakes. Its color is brown, checkered with dark brown and white, and with a reddish band between the eyes. It is of an indolent disposition. It loves to grovel in the sand, just leaving its wicked-looking head above the surface. The fact that it lies almost concealed of course adds to its danger, and for this reason the small number of deaths recorded as the result of its bite is remarkable.



WHITE RATTLESNAKE (CROTALUS MITCHELLII).

Other deadly serpents of the same region are the Das Adder, or River Jack (*Clotho nasicornis*), the males of which have a long curved horn on the nose; the Berg Adder (*Clotho atropos*), an ugly, thick-bodied, slow-crawling beast, with a suddenly tapering tail, and usually not more than eighteen inches long, and the Horned Adder (*Clotho cornuta*). This latter is sometimes, but erroneously, called the Cerastes, which is the true Horned Viper, a native of northern Africa, and by some believed to be the species responsible for the death of Cleopatra. Its color is pale brownish white, covered irregularly with brown spots, and its length is about two feet.

Another group of venomous Indian snakes may be alluded to by a reference to the Horatta Pam (*Echis carinata*), a rather small snake about fifteen or sixteen inches long. It is very poisonous, and to counteract its bite, a "double dose" of medicine is said to be necessary. It is grayish brown, with angular white streaks on the body, and large oblong spots on the head.

BANDED RATTLESNAKE (CROTALUS HORRIDUS).

Closely allied to the preceding species is the Asp, or Chersæa (*Vipera aspis*). It is rather common in many parts of southern Europe. Its bite is very severe, especially during the hot months. The Asp is olive in color on the upper parts, and has four rows of black spots.

Belonging to the same genus as the Asp is the Ammodyte, or Sand Natter (*Vipera ammodytes*), which inhabits southern Europe, and generally occurs in rocky places. Its bite is considered very dangerous. Like the Asp, it is olive above, with a broad dark streak on each temple, two similar streaks on each side of the head, and a wavy dark line along the crown of the spine.

A very deadly Australian snake of the Elapid group, and hideous of aspect, is the Death Adder, or Thorny Snake (*Acanthophis*). The "Yas" natives call it "Tammin" on account of the presence of a curved horny spine at the end of the tail, with which it is popularly believed to inflict a mortal sting. It is dull-colored, with dark bands shading off into the colors which characterize the back. It is thick in proportion to its length, which latter does not seem to average much over two feet. Its eye is a vivid yellow with a black pupil extending lengthwise.

Another venomous snake found in Australia, also of the Elapid group, is a species of Black Snake (*Pseudechis porphyriacus*). This is a very dangerous serpent, and is closely related to the Indian Cobra.

A third group of venomous serpents may be made up of those which live in the water, and a good example of these is the Black-backed Pelamis (*Pelamis bicolor*), or Nalla Whallagee Pam of the Indian fishermen. It aproaches land only to deposit its eggs. Curiously enough, it is forced to turn on its back before diving and can then be easily caught, although the fishermen are very glad to let it alone, for it has formidable teeth. The fangs are only a little larger than the rest of the teeth, but may be distinguished by the groove that runs along the front edge. Their average length is about three feet. Another of these marine snakes is the Chittul (*Hydrophis sublævis*) found in India and Ceylon. It is said to be extremely venomous. Its ground color is yellow, and the body is covered with an irregular row of black rings.

(To be continued.)

A New Use for Carborundum.

A new and interesting use has been discovered for carborundum, which has already found large employment as a substitute for emery. Capable of preparation only in a powerful electric furnace, where silica and carbon are fused together in presence of sawdust and common salt, carborundum is highly refractory; and it has been observed that a thin layer of the same substance applied to any other material of which furnaces are usually constructed, protects it from the heat and renders it almost equally refractory. Finely powdered carborundum is made up into a paste with water-glass, i. e., sodium silicate, or some similar binding substance; and the paste is applied by means of a brush or otherwise to the bricks which are intended to be used for building a furnace, or those bricks are actually immersed in the viscid liquid for a certain time. If the furnace has already been built, the paste can be painted on to the exposed surfaces, giving one or more coats as may be desired. It is stated that a layer 2 mm. thick will protect the bricks from the attack of the highest temperature which is ever produced by combustion methods in ordinary work. Examination of the bricks in such a furnace has shown that they had not suffered in the least. The skin of carborundum does not chip off, and is hard enough to resist mechanical injury.

About twenty years ago the United States government began the task of making a topographical map of the country. About a hundred years more will be required to complete the work. Begun in 1882, the work is being carried on in co-operation with the States. New York has appropriated the annual sum of $20,000 to $25,000 toward its share. There has never been a topographical map of the United States published other than rough sketches. For that reason the government work will be one of the largest ever made. What the cost of the map will be when finished it is difficult to state; the expense involved in mapping out New York alone will be about $1,000,000. The sheets relating to New York State will probably be completed within five years.

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Legal Notes.

THE BRISLIN-CARNEGIE SUIT—AN IMPORTANT PATENT DECISION.—John Brislin and Antoine Vinnac brought an action against the Carnegie Company in equity (118 Fed. Rep. 579) charging infringement of patent 345,393, granted to them for a feeding mechanism for rolling-mills. The bill also charged infringement of a patent granted to Patrick F. Hanley and Francis N. Richey, for a feed-table for rolling-mills, which patent was afterward assigned to Brislin and Vinnac. The usual defense of invalidity of the patents in suit and non-infringement was set up.

The decision is important, in that it subjects to patent monopoly the mechanical rolling of steel beams used in modern building. Inasmuch as it was contended that these patents were void, as not involving patentable novelty, the Court deemed it proper to study the advance made in mechanical iron-rolling, as contrasted with manual rolling, by those who preceded Brislin and Vinnac. In a general way, the art of rolling any size of iron consists in passing high-heated billets or blooms through differently-gaged roll-passes. This reduces thickness, but increases length or width. In manual rolling, men handle the metal with tongs, hooks, levers, and various appliances adapted to feed it on one side of the rolls, and catch and return it on the other. Where a stand of two rolls, technically styled "two-high rolls," is used, the return is made over the upper roll, while in a three-high stand a roll-pass both ways is made. Some kinds of iron are finished at a single stand of rolls; others transferred to an adjoining stand, which further reduces thickness and increases area. It will be apparent that, the bulkier the billets, with consequent lengthened product, the time, labor, and difficulty incident to manual handling increase. Moreover, as the process is prolonged, heat radiation either necessitates reheating of the finished metal; or, if rolling continues with the cooler and less pliable metal, risk of roll-breaking is greatly increased. Accordingly the trend of advance has been from manual to mechanical rolling, since thereby great masses can be easily and rapidly handled, and manual labor restricted to the mere operation of the machinery used. Moreover, it must be borne in mind that in heavy rolling a change to machinery is more than mere economic gain of a labor-saving appliance. The heat radiated from these huge, fervid masses, to say nothing of the bulk to be handled in the face of this heat, created limitations to human endurance, which machinery alone could overcome. That a significant advance in such rolling art has been made is apparent in a modern beam-mill. In measuring the real advance made by successive inventors in solving the problem of continuous mechanical rolling—and by that is meant a process where the finished product is wholly mechanically rolled—two facts should be borne in mind: First, the great economic gains incident to even a partly mechanical process were clearly recognized; and second, the key to the solution of the problem of continuous mechanical rolling, to wit, a pivoted table, was known to inventors, but unused, for upward of forty years.

Some of the advantages of mechanical rolling are forcibly stated at an early day by Sauvage in his patent of 1857; and a recognition of the advance incident thereto will be found in the patents of many subsequent inventors. With a well-recognized object in view, and with the pivoted table (which eventually solved the problem) in their possession, the work of subsequent inventors must be instructive in solving the question, whether its ultimate solution was a mere clever use of well-known means already at hand, or involved inventive genius. Turning to an examination of successive patents, the first is that granted to George Fritz, in which is found a horizontal table on each side of a three-high mill. These tables are adapted to be raised to the upper roll-passes and dropped to the lower ones by individual hydraulic cylinders. Reversible propelled feed-rollers constitute the beds of these tables, which rollers are adapted on the one side of the rolls to feed the iron forward to the pass, and on the other to carry it away as it emerged, and both are adapted to reverse the operation as the metal is returned. The other details of the patent need not here be referred to. In summarizing the pertinent advance made by Fritz toward mechanical rolling, it is to be noted that the vertical lift capacity of his device fitted it for use at a three-high mill, and its feed-rollers positively actuated when the table was at the upper as well as the lower pass, enabled it to do complete mechanical feeding and rolling at a single stand of three-high rolls. The substance of his contribution to the art was a lifting table and positively-actuated feed rollers. It is also clear, even at this early stage of the art's development, that Fritz recognized what is also recognized by several succeeding inventors, the special mode of applying power to his rolling agencies—in his case the lifting table and the propelled feed-rollers—was regarded as a minor matter, a question of mechanical methods.

The court did not overlook the fact that Fritz provided means for laterally moving the metal so as to feed it to different passes on the lower level. But this mechanism was no part of his table, nor could the table itself be laterally moved. Under his lifting table was an auxiliary carriage, adapted to be laterally moved parallel to the rolls by a hydraulic cylinder. On this carriage were horns, which, as the table was lowered, caught the metal lying on the table, turned it over, and pushed it opposite the desired pass. This double mechanism tends to emphasize, rather than minimize, the originality of a single device wherein the lateral shifting was of the table itself, and where the extent of the shift was from one stand of rolls to another.

The continuous use of the Fritz device suggested no change in the hand-rolling beside it, and led neither to its adaptation to more than one stand of rolls nor to the broad conception of a continuous mechanical process, the outcome of which was a wholly mechanically-rolled product. It must, therefore, be obvious that, if fourteen years later such device came into use, presumably it was not a mere mechanical adaptation in the Fritz device, it was not likely to lie dormant through years of inventive effort to reach such results.

The next step in time appears in the patent of Frederick J. Slade, of Trenton, N. J., No. 222,845, granted December 23, 1879. The device therein shown was confessedly not an original device, but simply purported to be an improvement on a patent to Charles Hewitt—No. 24,304, of June 7, 1859. Compared with Fritz's, Slade's device shows no advance, and in one important element it embodies a noticeable backward step. Like Fritz's, it was only adapted to operate at a single stand of rolls, and it was, therefore, no advance over the old device. But in that it lacked the Fritz positively-actuated feed-rollers it was a distinct step backward.

The next step is the patent of Christopher Lewis, of Columbus, Ohio—No. 276,665, of September 27, 1881. The substantial advance shown by Lewis was not only in making one carriage serve two stands of rolls, but in his use of a number of carriages he carried mechanical rolling through the entire process, thus securing what he styles a "continuous rolling mill." In Lewis we thus find the idea of the process of complete mechanical rolling continuous from the ingot to the finished product. His advance, however, by its lines of construction (and this as distinguished from the mere mechanical application of power) was limited to two-high rolls, and it necessitated the use of a considerable number of carriages on each side of the rolls. It is certain his device left no impress on the art. It should be noted that Lewis' entire mechanism was mounted on stationary tracks, and was a complete abandonment of the vertical movable table principle of Fritz and Slade.

The next stage of the art is shown in the patent of Samuel T. Wellman, of Cleveland, Ohio—No. 277,860, May 15, 1883. Here is found a return to the pivoted table. On either side of the stand of three-high rolls Wellman employs a table pivotally supported at its outer end on a stationary foundation. This construction, of course, leaves the inner end free to be raised or lowered to either roll-pass. In the bed of the table are rollers adapted to be positively revolved and reversed when the inner end of the table was at either angle. The inner ends of the table are raised and lowered simultaneously by a hydraulic cylinder placed on one side of the rolls. The feed-rollers are actuated by a single reversible steam engine. Wellman adopts the general prior teaching of the art, viz., the indifference of the mere modes of power application to his rolling agents.

So far as indicated by the patents in evidence, no further step is shown in heavy mechanical rolling until the Brislin and Vinnac patent in suit. The Fritz tables were used at the roughing stand of rolls for some time at Homestead, as they were elsewhere; but there is no proof that any one thought of rearranging or reconstructing them in combination with the elements shown by Lewis, Slade, or Wellman, so as to broaden the art of mechanical rolling. The Wellman type of mill was also widely used as a one-stand device, accomplishing as it did partly mechanical rolling. But partly manual rolling continued as to the remainder of the process besides these partly mechanical devices.

Brislin and Vinnac were both ironworkers, and were acquainted with the difficulties incident to this work. Brislin had given up millwork, but Vinnac continued as roller. A model was made which was placed in the hands of a patent solicitor to prepare specifications. The application was rejected on formal grounds before it was considered at all on its merits.

In the device shown are two carriages, one at each side of the rolls, and adapted to move on stationary tracks parallel with the roll axis. Those carriages are moved simultaneously from one stand of rolls to another by power conveyed through a shaft adapted to engage, through lever control, with the lower string of rolls. Upon each of these carriages is a mounted table pivoted near its outer end, and the distance to its inner end is such as to permit it to reach both upper and lower roll-pass. Such inner end rests upon the slides along a bar suspended by chains in front of the rolls. One of these bars is on each side of the rolls. These bars have a supporting chain, and the chains of both bars connect and are drawn up and released by a single mechanical contrivance, so that the inner ends of the tables rise and fall together. It will be noted—and this fact the court deemed helpful and explanatory in construing the language used in the body of the patent in describing the invention—that the table-lifting mechanism is not entirely independent of the rolls as a whole, but has no connection whatever with individual parts of the rolls, to wit, the carriage, with the middle string, which propels the feed rollers, or with the idling upper string. In other words, the table-lifting mechanism—and this is a significant fact, and one to be fully appreciated—is entirely independent of roll connection.

In the Brislin-Vinnac device is found for the first time in heavy rolling the combination of a pivoted table, adapted to feed metal at both the upper and lower passes of more than one stand of such rolls. No one prior to Brislin and Vinnac thought of, much less embodied in form, the coupling of a pivoted table and a movable carriage. Conceding that all the elements of Brislin and Vinnac were in themselves old, yet, in the opinion of the court, it must be conceded that they were the first to take the separate, individual elements of advance in the rolling art, and so combine them as to accomplish continuous, complete mechanical heavy rolling, and to make possible a new product, to wit, a machine-rolled heavy beam. The separate steps of Fritz, of Slade, of Lewis, and Wellman, securing lateral movement, vertical movement, and tilting movements, were each deemed worthy of patent protection and reward. Why then, asks the court, should the steps of Brislin and Vinnac, which carried this advance to the culmination in combining lateral and vertical in such a way that both movements could be used in each form of roll to which prior inventors had succeeded in applying but one of such movements, be deemed not only worthy of patent protection, but of such favorable regard as the broad and important field it pertained to would warrant? A device which transfers from the field of human toil to mechanical work the handling of huge masses of iron heated to a point almost prohibitive to human handling is a beneficent factor that is not to be measured by the economies of a mere labor-saving machine. The significance of this the Brislin-Vinnac combination cannot be minimized. It was not the mere placing together of two elements, each of which in the new relation continued to travel in its old orbit, and accomplish the same result it had done singly. The union of the two left neither the same as before. The lateral movement of the carriage widened the sphere of the table so that it served a plurality of roll-stands. The vertical motion of the pivoted table doubled the sphere of the carriage, in that, while remaining on stationary tracks, it could reach a roll-pass on a level other than its own. The power to move existed in one factor. The power to reach existed in the other. The union of the two gave to the moving factor the power to reach; gave to the reaching factor the power to move. In this flexible roller we have a new mechanical factor; in its work we have a new result, viz., a machine rolled product. Thus the two elements of a lateral shift carriage and a pivoted table, elements old in themselves, known and used for years, when united accomplished a novel result in a novel way. A decree was entered for the plaintiff.

UNFAIR COMPETITION CASE.—The case of Samuel Brothers & Company against the Hostetter Company (118 Fed. Rep. 257) brings out just what is meant by unfair competition in trade. The appellee brought suit against the appellant, charging him with selling for the appellee's preparation, an article of bitters resembling that of the appellee. The evidence upon which the Circuit Court sustained the charge of unfair dealing against the appellant, was the testimony of two witnesses who were in the employment of the appellee. These two witnesses testified that they went to the wholesale liquor store of the appellant, where the spurious bitters were sold by a clerk in bulk. The witnesses stated that, in addition to the bitters, they were furnished with empty bottles bearing the appellee's label and trade-mark, to be used in retailing the bitters to consumers. Such evidence, the Court of Appeals held, was sufficient to support the Circuit Court's finding that the defendant was engaged in unfair competition, although there was no proof that any customer had been actually deceived. The case may be considered in many respects typical of the protection afforded by courts of equity against unfair competition,

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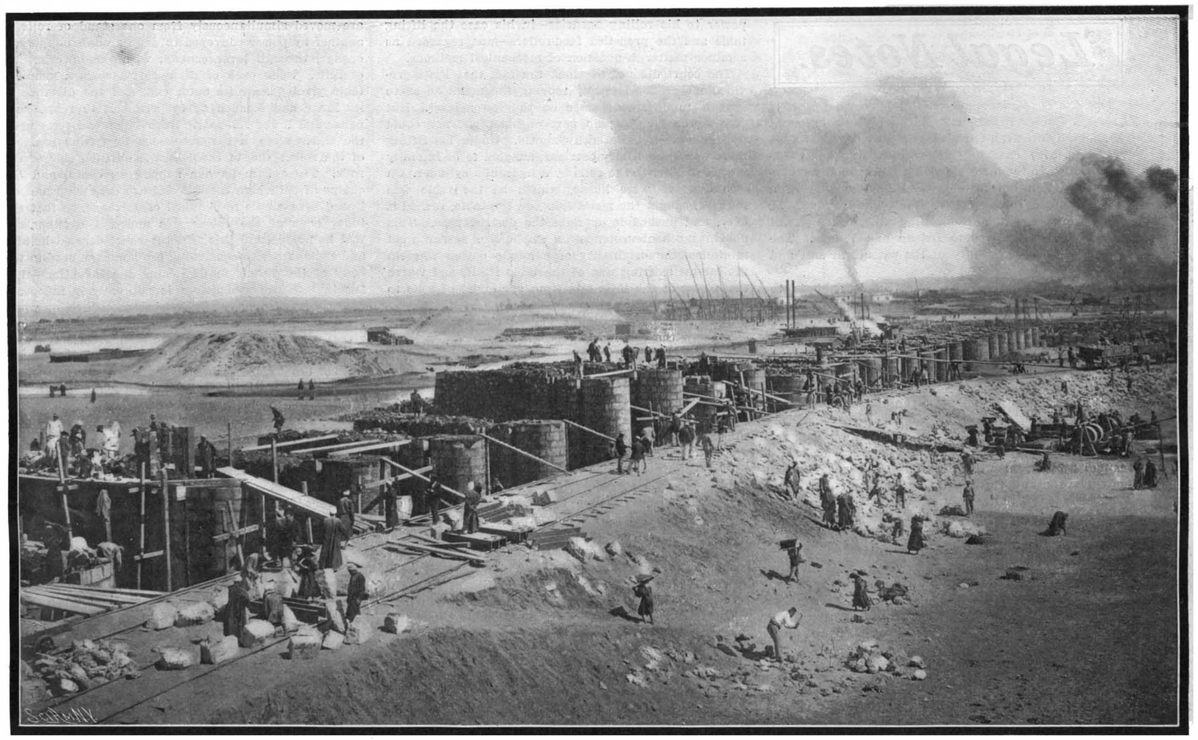
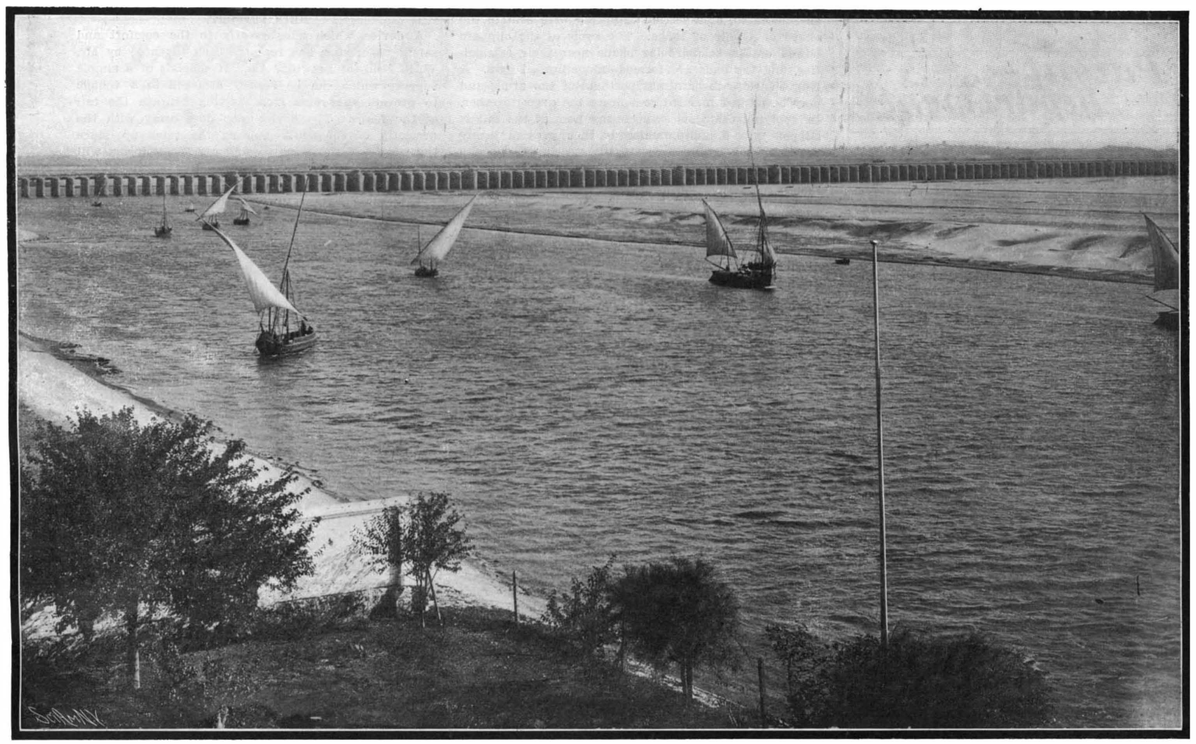
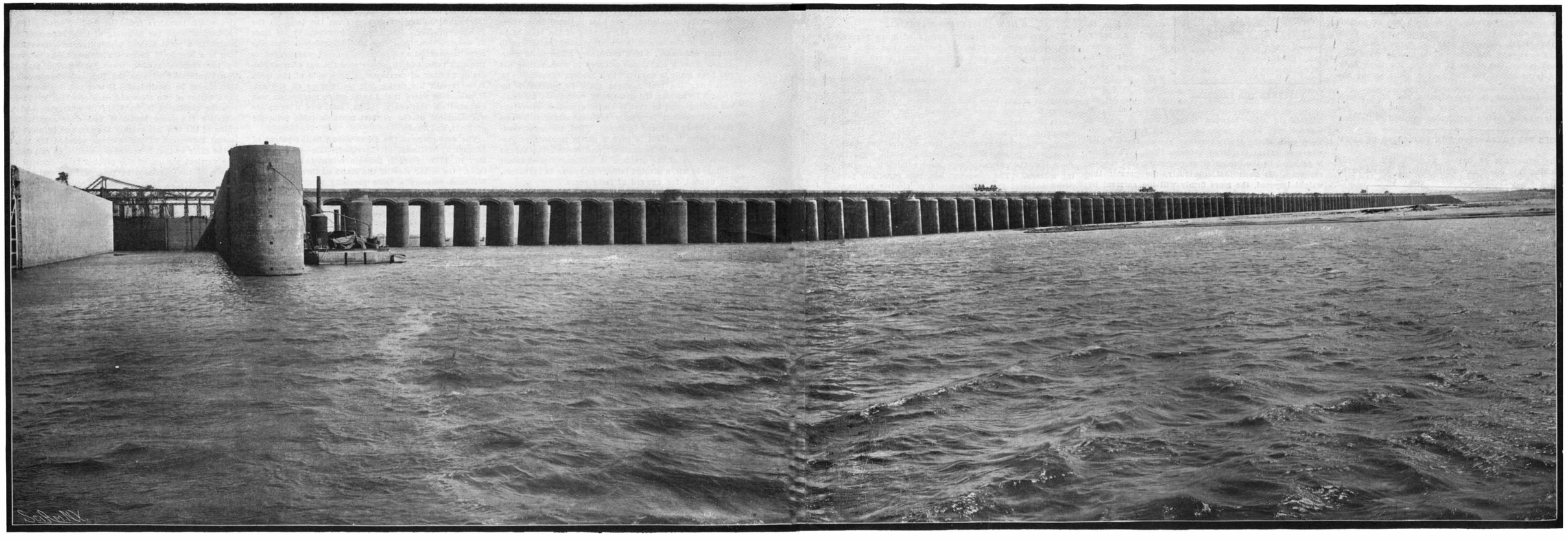


Method of Constructing the Barrage. The Temporary Dams for Excluding the Nile Waters are Seen on Either Side of the Structure.



General View of the Nile as Diverted Into Its New Channel, with Barrage Sluices Open.



This work should not be mistaken for the Great Dam at Aswan, formall opened by the Duke of Connaught on December 10th of last year.

PANORAMIC VIEW OF THE GREAT ASYUT BARRAGE ACROSS THE NILE, OVER HALF A MILE IN LENGTH, SHOWING THE NAVIGATION LOCKS TO THE LEFT.

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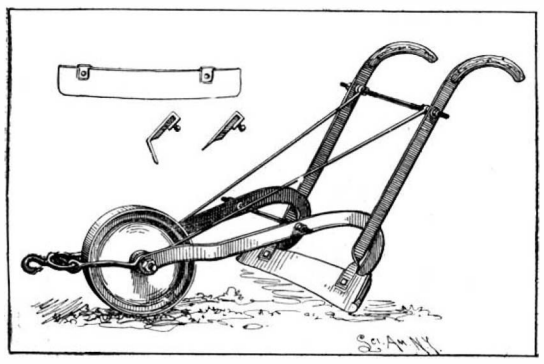
Patent Department

ADJUSTABLE SURFACE CULTIVATOR.

A surface cultivator which can readily be adjusted to various widths between rows, and to which cultivator teeth or small plows may be quickly attached when it is desired to cultivate the ground more deeply, forms the subject matter of an invention recently patented by Mr. W. S. Neal, of Brewton, Ala. This device is adapted to be moved by a single horse and guided by hand. With the shovel blade attachment it will be found particularly useful in removing any vegetation in its path, and will likewise destroy any crust which may have been formed on the top of the ground after a rain, for example. The shovels used in



ADJUSTABLE SURFACE CULTIVATOR.

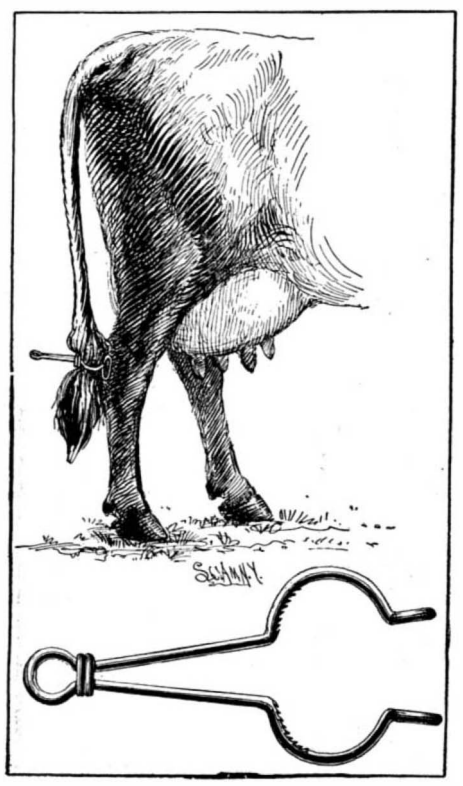
this implement are detachable, and of varying sizes suitable to the width of the space between the rows to be cultivated. The ends of the shovel blade extend backward at an angle to the body of the blade, so as to shovel the soil laterally among the plants in the drill and cover up any little vegetation that the blade cannot reach without cutting the plants. Another type of blade also is provided, which will be found useful for certain conditions. This blade, as shown in the engraving, is rounded at the lower corner of each end, so as to prevent injury to the plants.

These blades are sufficient for ordinary surface work, but when deeper cultivation is required, cultivator teeth may be attached to the shovel blades, as shown in the sectional views. These teeth are of various sizes and shapes to suit different requirements. Some of the blades employed may be turned backward, others downward, and others again may be made with turned ends. The object of turning the teeth backward is to shovel the dirt in the drills among the plants.

The implement is very effective and of a simple construction. It is also very light, and by its use plants may be readily kept under required cultivation.

DEVICE FOR PREVENTING THE SWITCHING OF COWS' TAILS.

The annoyance of having a cow's tail suddenly switching into one's face while milking, may now be

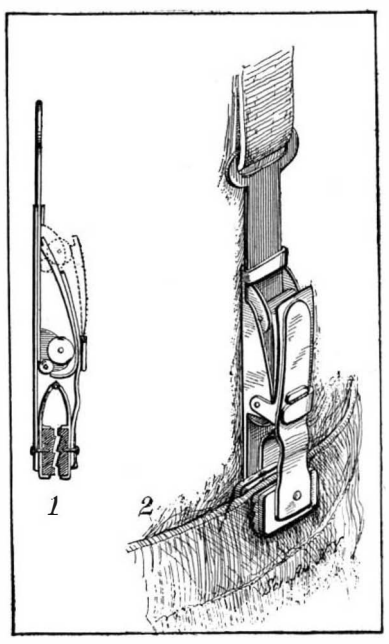


CLIP FOR COWS' TAILS.

prevented by applying a small clip to the pestering member and securing it to one of the legs of the animal. This clip is the invention of Mr. David McLellan, of Bowesmont, North Dakota, and consists, as illustrated, of a section of spring wire bent to the shape of a pair of tongs. The arms of the clip are bowed out in semicircular shape near their extremities, and the ends are formed into elliptical eyes. A ring encircles the straight portions of the arms, and may be pushed forward to squeeze the arms together. In applying this device the bushy part of the tail is slipped into the clip, which is then pressed firmly against the animal's leg with the eyes upon opposite sides. The ring is now pushed forward, forcing the spring arms together. The tail is thus tightly held between the leg and the semicircular portions of the clip, which are roughened to prevent slipping. The semicircular portions fit over the tendon of the leg near the upper shin joint, and the eye portions sink into the hollow between the tendon and the bone. The device can be very quickly applied or removed, and will effectually prevent the undesirable switching of the animal's tail, thereby saving the milker from much annoyance and securing cleanliness of the milk.

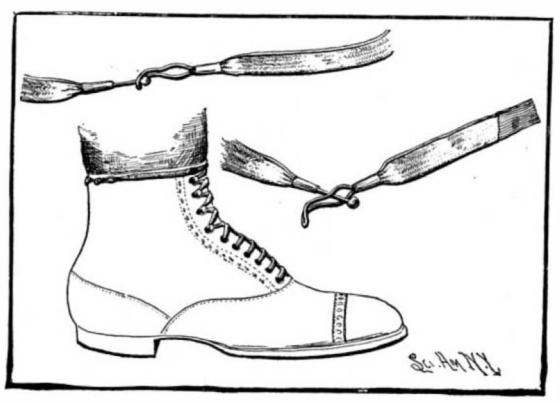
TWO SIMPLE FASTENING DEVICES.

A new method of fastening one's shoe-laces is provided by the invention which we illustrate herewith. It consists of a pair of simple fasteners secured to the ends of the shoe-laces, whereby they may be wrapped about the ankle and readily fastened together. In order that the laces may fit any ankle, they are provided at the ends with elastic strips two or three inches long. This arrangement permits yielding of the ties with the movements of the foot. The invention offers the additional advantage of facility in unfastening the laces and security as well as facility in the fastening of the same.



FASTENER FOR TROUSERS.

Mr. Edward L. Pitts, of Jerome, Ariz., who invented this novel shoe lace, is also the inventor of a simple means for attaching a garment to a supporter without the use of buttons or the like. The device is especially adapted for use on suspenders, to afford a ready means for securing the trousers. It consists of a pair of jaws hinged to a pair of levers. An operating slide is adapted to slide between these levers in such a manner that when drawn back it will force the forward ends of the levers together, closing the jaws on whatever fabric is placed between them. The slide is fastened to the supporter or suspender, and the arrangement is such that, obviously, the greater the weight imposed, the more firmly will the garment be grasped and held by the jaws. On account of this hinged connection between the jaws and the levers, perfect freedom is permitted in the movement of the garment; also the area of cloth grasped by the jaws



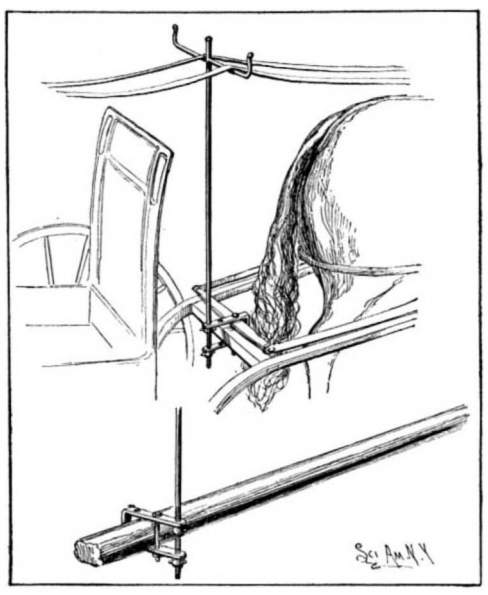
FASTENER FOR SHOE-LACES.

is so great, comparatively, that a strain which would tear off a button may be safely imposed upon them. When it is desired to release the garment from the grip of this device, the operating slide is moved forward, thus permitting the levers to swing to open position.

A powerful company has been organized, made up of moneyed men of Toledo, Ohio, and Buffalo, N. Y., for the purpose of starting a plant to make radiators of pressed steel according to a new process which has been briefly described in these columns. The location of the new plant has not yet been finally determined.

REIN SUPPORT.

A device which adds greatly to the comfort and safety of driving has recently been invented by Mr. W. S. Neal, of Brewton, Ala. It consists of a simple support which can be readily attached to a vehicle to prevent the reins from getting beneath the tail of the horse. The device also does away with the necessity of constantly holding the reins up, since the weight of the reins passing over the support will keep them taut. The driver is thus at liberty to rest his hands on his lap. The support comprises a rod, provided with a cross-piece at its upper e on

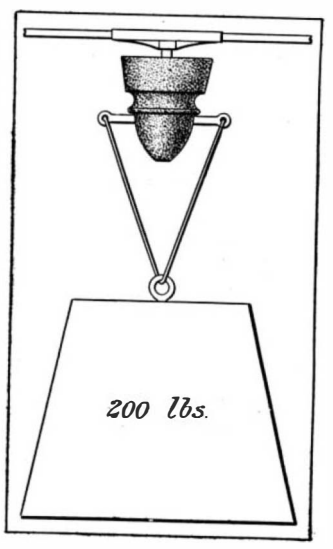


REIN SUPPORT.

which the reins are supported, and at its lower end it is threaded into a clamp which secures it to the vehicle. This threaded connection permits the device to be adjusted to any convenient height, where it is secured by lock nuts. When applied to a one-horse vehicle, the rod takes the place of the bolt which ordinarily holds the cross-bar and single-tree together. When applied to a two-horse vehicle, the clamp is slipped around the tongue, or it may be attached to the single and double trees of the vehicle in the same manner as applied to the cross-bar and single-tree of a one-horse vehicle.

A NEW INSULATING MATERIAL.

The gradually decreasing supply of gutta percha, and the expense of vulcanite, porcelain, and glass insulating materials, have prompted many inventors to devise compositions which will fulfill the rigorous requirements imposed by the transmission of electrical energy at high voltages. Of the many new insulating materials which have been introduced of late is one which bears the name "Electrose," the invention of Louis Steinberger, of the Electrose Manufacturing Company, 127 North Tenth Street, Brooklyn, N. Y. Very careful and exhaustive tests of electrose made by experts in electrical engineering, would seem to show that the substance is a most admirable insulating material. The compound has been especially prepared to meet the requirements of electric railway, light, and power insulation. It is very hard, dense, tough, and strong, of a brownish hue, resembling somewhat that of certain varieties of oak. The compound is cast in the various forms which are required, so that the drilling and working necessary for some of the materials formerly used for electrical work are no longer necessary.



TEST OF AN ELECTROSE INSULATOR.

Elaborate tests which have been carried out by the engineer of the Niagara Falls Power Company and by Prof. Sheldon, of the Brooklyn Polytechnic Institute, give some idea of the resistant qualities of this new material. The Niagara Falls engineer found that a cap with an embedded bolt arced across at 30,000 volts; a round-top, straight line hanger arced across at 11,000 volts; a square foot of the material one-quarter of an inch in thickness arced around at 80,000 volts; an 8-inch round column arced around at 100,000 volts; as did also an 8-inch hexagonal column. None of these specimens was punctured, with the exception of a ball insulator, which was punctured

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at 14,000 volts, the puncture being probably due to some mechanical defect.

In order to show that the round-top hangers of electrose fully meet the requirements of trolley line construction, Prof. Sheldon carried out the test, which is illustrated in the accompanying diagram. A round-top hanger was suspended, free from draft, in an inverted position by means of a bronze ear, weighing 8 ounces, and measuring 5½ inches in length, the ear clamping the metal on a round rod of soft iron, one-quarter of an inch in diameter and 20 inches long. From the hanger top was suspended a weight of 200 pounds. A current of 200 amperes was passed continuously through the rod for one hour. The rod was thereby maintained at a red heat. This supply of heat, which is practically the same as would be given by a red-hot trolley wire of the same size in the same time, did not affect the electrose insulation to such an extent as to allow the 200 pounds weight to tear asunder the metal parts of the hangers. Prof. Sheldon tested a feeder insulator under a voltage of 70,000, but the insulation did not break down. Similar satisfactory results were obtained with cap and cone hangers, feeder insulators, globe strain insulators, solid bolts, terminal strain insulators and sheets.

The resistance of the substance to atmospheric influences and general wear renders it of great service for outside work. The substance is molded into many forms, and can be used as a general substitute for rubber, not only in electrical work, but in photographic and other work as well.

Amendment of the Patent Law of Great Britain.

Two very important amendments have been made in the patent law of Great Britain, one of which provides for the examination of patent applications to ascertain whether the inventions for which protection is desired are novel, and the other relates to the manufacture of patented articles in Great Britain, and the grant of compulsory licenses.

As many of our readers are aware, patents have been granted in Great Britain under the old patent law, without any inquiry to learn whether the inventions were patentably new, according to the law and practice of that country. Without any examination and no aid from the Patent Office, it was almost impossible to so draw the claims that while covering all to which the inventor was entitled, they would not include more. Few inventors understand the difficulty in so preparing British patent application papers and drawing the claims that the patent will be valid without the necessity of incurring considerable expense for amendment after it is granted; for the British law looks at the patent deed as an entire instrument, and, should the patentee claim anything to which he is not entitled, the patent is invalid until amended, even as to such portions as would be valid were they not included in the grant with that which the court holds not to be patentably new. It will therefore be seen that it is necessary to have every claim in a British patent valid in order that the granted rights may be enforced. American inventors seldom file their British patent applications until their United States applications for patents on the same inventions have been acted on by the examiners in our Patent Office; and, as the official examination in this country covers not only United States, but British and other foreign patents, the failure of the Patent Office in Great Britain to make an examination as to novelty was not nearly so burdensome to our citizens as it was to British subjects and citizens of other countries. Nevertheless, much trouble was occasioned by reason of different rules of construction, under which claims prepared to avoid references in the United States would very often be held to be anticipated by the same reference in Great Britain.

The amendment which provides for an examination to cover all British patents issued within fifty years of the filing of an application under the new law will do much to inform inventors and other interested persons of the state of the art to which the invention relates, but it is not understood why the examination should be limited to British patents, as other publications might be cited by infringers to invalidate the patent grant. The fact that the examination will not extend to patents granted more than fifty years before the filing of the application is not so important, as it is provided that such patents in themselves shall not be deemed to anticipate applications filed under the new law.

Power is not granted to the examiner or Comptroller to reject patent applications on references, but where the applicant will not amend the papers to avoid the cited British patents, the Comptroller is authorized to make reference to the cited patents in the applicant's specification when it is printed. The question of novelty will therefore in all cases be decided by the courts of Great Britain under the new law, as has been the practice in the past. While the amendment has received the King's assent, it still remains for the Board of Trade to direct when the new provisions will come into operation, as the staff of the British Patent Office will have to be increased, and other changes will have to be made before the additional work which the examinations will involve can properly be cared for.

Under the second amendment, which applies to patents granted before, as well as after, the new law went into force, any interested person, who alleges that the reasonable requirements of the public with reference to the patented invention have not been satisfied, may petition the Board of Trade for the grant of a compulsory license, or, in the alternative, for the revocation of the patent. Unless the parties come to some arrangement between themselves, the Board of Trade, if satisfied that a *prima facie* case has been made out, will refer the petition to the Judicial Committee of the Privy Council. Should it be proved to the satisfaction of the Judicial Committee that the reasonable requirements of the public with reference to the patented invention have not been satisfied, the patentee may be directed by an Order in Council to grant licenses on such terms as the said committee may direct, or if the Judicial Committee are of the opinion that the reasonable requirements of the public will not be satisfied by the grant of licenses, the patent may be revoked by an Order in Council. The reasonable requirements of the public will not be deemed to have been satisfied if, by reason of the default of the patentee to work his patent or to manufacture the patented article in Great Britain to an adequate extent, or to grant licenses on reasonable terms, (*a*) any existing industry or the establishment of any new industry is unfairly prejudiced, or (*b*) the demand for the patented article is not reasonably met. It is, however, provided that no order of revocation shall be made before the expiration of three years from the date of the patent, or in cases where the patentee gives satisfactory reasons for his default. This provision has in view the manufacture of patented inventions in Great Britain, and the protection of that country's industries. Much will depend on the view of the Judicial Committee on the question of compulsory licenses, and the revocation of patents, but it is thought that the rights of deserving patentees will receive every consideration, and that the committee will not revoke a patent except in such rare cases when the demands of the British public will not be fully satisfied by a compulsory license granted to a manufacturer in Great Britain.

Origin of the Sliding Pole.

The recent death of Stephen Paine, a retired colored member of the Chicago department, has renewed the old story that he invented the sliding pole which was first used in the station of Engine Company 21 at Twelfth Street and Third Avenue, the only colored company in that department, of which he was a member and driver.

The idea of a sliding pole originated in 1878 with Captain David B. Kenyon (white) of that company, a brother of Joseph L. Kenyon, now chief of the Twelfth Battalion. At that time Matthias Benner was chief of department, and M. W. Shay, chief of the First Battalion, in which 21 Engine Company was located.

Captain Kenyon, who was a most intelligent and progressive fireman, and a most competent commander, wanted something better than the slide on side of stairs in his station, which was also used in other stations. He conceived the idea of the sliding pole and Steve Paine procured at a nearby lumber yard a 4x4 piece of timber which members of the company, under Captain Kenyon's direction, rounded down into a pole three inches in diameter, which was sandpapered and rubbed down smooth with paraffin.

It was erected as an experiment from the hay loft window at the rear of the station and its trial proved a most satisfactory success. Obtaining permission from Chief Benner to cut a hole in the floor and run the pole from bunk to engine room on condition that he make good the damage done if it was not a success, the pole was placed there April 12, 1878, and was the first sliding pole ever used in a fire station. George Reed, a member of the company, now a member of the police force, was the first man to slide down the pole.

It was a success from the start, and this company were soon crowding the others hard in rapidity of hitching. May 24, a second pole was erected in this station and later a nickel-plated iron pole was erected, and about 1883 brass poles were used.—Municipal Journal and Engineer.

We note with pleasure that the House of Representatives has passed the bill No. 17,085, designed to harmonize the United States patent statutes in accordance with the International Convention. As the importance of the proposed amendment cannot be overestimated, it is to be hoped that Senator Pritchard, as chairman of the Senate Committee on Patents, will urge the measure, so that the bill may be passed by the Senate before the adjournment of Congress. We will publish a full account of the proposed amendment in a later issue.

Brief Notes Concerning Patents.

There have been 109 patents issued covering apparatus for wireless telegraphy. Of these, 71 were issued during last year.

Signor Dott Guiseppe Musso, of Genoa, Italy, arrived in New York recently to exploit a wireless telegraph system. He is about to build an apparatus and demonstrate its merits in practical operation. He says with his device it is possible to record the messages automatically, and printed in type directly from the receiving instrument without the use of any auxiliary apparatus whatever.

Consul-General Hughes at Coburg, Germany, is responsible in an official report for the statement that some of the more enterprising of the German manufacturers of cotton goods are about to make a trial of the discovery of Dr. W. H. Perkins, of Manchester, England, whereby cotton and other similarly inflammable materials are rendered permanently fireproof. The process is known as "asbestinizing," and it is said that after it has once been treated, it retains its fireproof quality even after repeated washings.

An inventor who lives in Minneapolis, Minn., has devised a means for ascertaining the speed by which an automobile or other vehicle is running. The device, which is named the Hodgson speed indicator, consists of a double dial with index hands which are moved automatically from the running gear of the machine. The double dial shows the speeds from either side. Two index hands are used. One travels forward and recedes, keeping pace with the speed of the vehicle; while the other travels forward so long as the speed continues on the increase. The index hands are moved by the centrifugal force of weighted arms.

The Cedar Rapids, Iowa, Republican in the issue of September 5 published a lengthy article dealing with the question of the identity of the inventor of the tank car for the transportation of live fish. The assertion which has been going the rounds that this type of car was the idea of an Illinois man named Bartlett is, according to the Republican, erroneous, and that paper states that the credit is due alone to B. F. Shaw, of Cedar Rapids, who was given assistance and facilities for carrying out his ideas by C. J. Ives, then the president of the B., C. R. & N. RR. This plan was in active operation in Iowa, it is said, a long time before Mr. Shaw built his car in Illinois.

Following the example of the Japanese nation, the Chinese are making a study of the methods in vogue at the United States Patent Office, and in the course of a few years the Celestial government will have a patent system, modeled largely on our own. The new Chinese minister to this country, accompanied by Lieuts. Tseng and Fang, recently paid a visit to the Patent Office, and inspected the vast building under the guidance of the Commissioner and Chief Clerk Ireland. Lieuts. Tseng and Fang belong to the Imperial army, and they have been assigned to the duty of looking up the details of the system of this country and of organizing the new department of their home government.

Radiators are now made of pressed steel and they are said to have many advantages when constructed of this metal. In the first place, because of their exceeding lightness they are much easier to handle than those of cast iron, and the saving in the matter of freight charges is considerable. When set up they are almost instantly available for heating, as the metal is so thin that the heat is transmitted at once. In the manufacture of this radiator, each section is made of two sheets of steel which are pressed, punched, and sheared into shape separately. The two halves are brazed together while being held in a clamp and this joint has, it is said, withstood a pressure of 100 pounds to the square inch. Truss rods are used to hold the parts together, and the assembling is done in a machine exerting a powerful pressure.

The magnetic T-square, an English invention, is a device designed to give the free use of both hands to the draftsman while making use of the implement. The true edge of the board is fitted with an iron strip ground true and a number of small horseshoe magnets are imbedded in the stock of the square. This affords sufficient adhesion to support the square with the board in an inclined or vertical position, leaving both hands of the draftsman free. Another innovation in the drafting room is an illuminated table which is in use in Boston with great success. A section of the table top is cut out and a piece of plate glass inserted. In the drawer of the table a cluster of incandescent lamps is placed, supplied with a porcelain shade. This can be moved about so as to bring it immediately under that part of the work which it is desired to trace. This table has been found very useful in making tracings on thick paper from drawings having weak lines, the comparison of alternative designs, and the tracing of additions directly on brown paper drawings or blue prints.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CORN-HARVESTER.—W. E. KOCH, Duvall, Ohio. This machine in passing alongside a row of corn advances the lifters that guide the stalks into passageways. Endless chains with lateral arms force the stalks back until pressed and cut by disk cutters. Star-wheels then come into action and move the cut stalks inward, when the pushers force them backward into passage-ways on the rear of the platform. When thus moved backward, retarders resist the advance of the stalks, so that they are compacted to form a shock. Then the binding cord is drawn off and when enough stalks have heaped, the machine is stopped, and the cord cut and tied around the shock ready for discharge. Means are now provided for sliding the shock downward and resting it on the ground, whereupon the machine advances, leaving the shock braced in standing position.

Engineering Improvements.

ROTARY ENGINE.—J. C. WHARTON, Nashville, Tenn. This engine is of the type in which two cylinders put side by side are provided, respectively, with oppositely-moving pistons, which are rigidly connected by a diaphragm, which passes through from one cylinder-chamber to the other, the induction and exhaust ports being located on opposite sides of this diaphragm, one above, the other below it. This diaphragm connecting the rolling pistons has a tilting movement, as a lever upon a fulcrum, and also a sliding movement through the opening from one cylinder to the other, to accommodate the reverse rolling of the pistons under influence of steam pressure.

Hardware.

PRUNING IMPLEMENT.—H. A. HILL, Lawrence, Mass. This tool is so constructed that by the manipulation of opposing hinge-connected handles a spring-controlled blade will be operated in a sheath having a recess in its side to receive the twig to be cut, and across which recess the blade passes through the action of the handles with a positive end thrust, making a clean cut. There is a readily detachable sheath for the knife, and a short knife concealed within and protected by the sheath and means whereby the knife when injured or worn can be removed and replaced.

Heating Apparatus.

HEATING-STOVE.—C. MATTHEWS, Columbia, Mo. By novel details of construction in the make-up of this stove, the inventor secures an increased and more effective heating surface. An essential feature of the invention resides in the facility afforded for cleaning out passage-ways through a compartment door. Any suitable grate may be used, and well-known raking devices or attachments employed.

PETROLEUM-OIL BURNER.—A. F. DEMORY, Nacogdoches, Texas. Mr. Demory's useful improvement is in the nature of a novel construction and arrangement of burner for utilizing crude petroleum to furnish heat, power, and light for the use of heating and cooking stoves, bake ovens, furnaces, for hot air, steam, or water, the boilers of ships and locomotives, and various other uses to which it may be applicable.

Mechanical Devices.

PLATE-PRESS ATTACHMENT.—R. TURNER, New York, and B. R. CORLEY, Brooklyn, N. Y. The patent in this case relates to copper and steel plate printing; and the purpose of the invention is to provide a new and improved plate press attachment in which the simple and durable construction, thorough effectiveness in operation, and the automatic arrangements to stop the plate-press after each impression, are the recommendatory features.

COPYING-PRESS.—H. L. DAVIDSON, Louisville, Ky. The mechanism employed in this device is that in use in copying-presses where rollers are used; and the objects of the improvement are to furnish a press not complex in construction, very effective in use, doing its work rapidly in copying on detached sheets or on a continuous strip or in a book, and all at a small cost.

EYELET-MACHINE.—I. W. GILES, New Bedford, Mass. The usual manner of producing eyelets has been improved by the present method, wherein the edges of the eyelets have been upset—that is to say, the metal has been crowded back upon itself. The eyelet-rims thus formed require to be polished by a subsequent operation with a separate machine. Mr. Giles's device performs the double function of upsetting the lateral edge of an eyelet and also burnishing and polishing it at one operation.

SPIRAL ELEVATOR.—D. E. CONDON, San Francisco, Cal. The inventor of this traction device has for his object the provision of a new spiral elevator for use in observation-towers, rotundas of high buildings, and the like designed for pleasure-trips, for business, industrial, and other purposes, and arranged to insure perfect safety to every one using the elevator.

SPOKE-FINISHING MACHINE.—G. A. ENSIGN, Defiance, Ohio. This invention relates particularly to spoke-finishing machines, such as one patented by Mr. Ensign in 1901. The present machine embodies improvements whereby ordinary wagon-spokes or Sarven spokes are accurately and uniformly finished at the throat, it requiring only an unskilled workman to attend the machine—that is, to remove the finished and to place the unfinished spokes in the automatically-turning spoke-holder.

WINDMILL.—J. HENDERSON, Millgrove, Mo. This form of windmill has the wings vertically placed, transversely curved, and pivoted at their ends in a circular group, one wing overlapping the other. The mill also has means for limiting the movement of the wings. A governor is provided which regulates the speed of the wheel by directing the extent to which the wings shall open. The stopping of the wheel is done by completely closing the wings one upon the other.

SPROCKET-WHEEL.—C. C. KEYSER, Newport News, Va. This description of sprocket-wheel is particularly adapted for use in connection with motor-bicycles or motor vehicles. It is simple in construction and is provided with spring-yielding parts, whereby jarring or vibration is avoided while riding, starting or stopping.

CHIME-RINGING DEVICE.—H. A. WENDE, Buffalo, N. Y. Mr. Wende in this invention provides improvements in devices for ringing or controlling the ringing of a chime of bells. He employs a simple electrically-released hammer-actuating mechanism which may be located close to the bells. After installation no adjustments are required.

BRAKE ATTACHMENT FOR ELEVATORS.—G. W. CHAMBERLAIN, Atlanta, Ga. The purpose of this contrivance is to supply a brake mechanism which can be manually operated at any time, but which is especially adapted to be automatically operated to apply the brake when the elevator reaches predetermined points at the top and bottom of the shaft, thereby preventing shocks or accidents at such points by the operator failing to act on the check-rope quickly at the proper time. The device provides for the automatic stoppage of the car at any floor, for which the means are set.

Railway Improvements.

RAIL-BENDER.—C. A. DAVIS, Rockvale, Colo. The inventor in this improvement has designed an apparatus for bending metallic bars, particularly railway-rails, and by its means railway-rails may be straightened, or, if straight, they may be bent to form curves therein, adapting the rails to curved tracks.

RAIL-FASTENING FOR RAILROAD-TIES.—F. FOSTER, Columbus, Ohio. Mr. Foster's invention relates to rail-fastenings for that type of railroad-ties known as "metallic ties," and has for its object to provide a tie and fastening which shall be durable, simple in construction, by means of which the rails may be firmly clamped, easily adjusted or removed, and which will permit contraction and expansion of the rails.

CAR-FENDER.—J. P. THOM, New Orleans, La. In designing this improvement in fenders, the object is to provide one of simple construction that will automatically move to safety position upon coming in contact with a person or object, and, further, to provide a wheel-guard that may be instantly lowered should the fender not strike a person or object and therefore not be thrown outward.

CAR-COUPLING.—B. BRAND, Braila, Roumania. This coupling is operated from the side of the car. The coupling hooks or links, as the case may be, are rigidly connected with toothed sectors pivotally secured in the fork-shaped end of a draw-rod moving in guides and pressed backwardly by springs and so actuated by means of a toothed eccentric disk on a shaft provided with a crank-handle at the side of the car that a rotation of the disk forwardly may be effected, and therefore a turning of the sector carrying the hook for the purpose of effecting the coupling.

RAIL-JOINT.—C. A. SNIDER, New York, N. Y. In working out this project of an improvement in rail-joints, Mr. Snider has succeeded in providing a simple and novel construction whereby the rails will be securely united at their junction and in which the joint-sections will be clamped together by a wedging action.

RAILWAY-SWITCH. — A. YOUNGBLOOD, North Augusta, S. C. Mr. Youngblood has invented an improved railway switch which can be operated by the engineer from the cab of the locomotive. An "operating projection" is provided at each side of the pilot of the engine. Either of these may be brought into contact with its respective co-operating cam rail along the track to throw the switch in the corresponding direction.

SWITCH-DEVICE.—L. HORINKO, New York, N. Y. The operation of this switch is from a moving car; and a mechanism is provided for shifting a switch-point, which mechanism is located below the road-bed and is protected against inclement weather, initial points only of such mechanism appearing at the tread of the rails. A rocking roller-trip device is provided for the switch-shifting mechanism, which device is carried by the car-motor or engine and is operated to engage with either exposed initial point of the switch-operating mechanism to automatically throw the switch point in the desired direction.

Vehicles and Their Accessories.

DUMPING-WAGON.—A. TUFANI, New York, N. Y. The purpose of this invention is to provide a new and improved dumping-wagon which is simple and durable in construction and easily manipulated for moving the wagon bed or box into an inclined dumping position or back to a non-dumping position.

TRACE-BUCKLE.—J. B. BUNKERS, Remsen, Iowa. In the design of this improved trace-buckle, the inventor's object is to provide a buckle that holds the tucked-in portion of the trace by two pins, thus rendering it much stronger and saving material in the trace, and also one in which there will be no wear on the cross-bars of the buckle upon the trace.

BICYCLE-BRAKE.—A. E. WAHLIN, Fairview, Utah. This new and improved bicycle device belongs to that class of brake which is arranged to work against the rim of a bicycle wheel as contradistinguished from the tire thereof. Two brake shoes are employed which are arranged one at each side of the rim of the rear wheel and are operated by a cord connection from the handle bars.

Miscellaneous Inventions.

NOZZLE.—W. C. OBERWALDER, New York, N. Y. This invention provides a nozzle for water-hose which shall be furnished with means to eject a stream of water of any desired form—for example, a concentrated or direct stream or a spraying stream—thus adapting the device to a multiplicity of uses. This is attained by features of construction embodying a conical divider, placed in the mouth of the nozzle and longitudinally thereto, to determine the form of the stream ejected.

MOVABLE FIRE-ESCAPE BALCONY.—MARTHA L. CRONIN, New York, N. Y. The object of the invention is to furnish a new movable fire-escape balcony arranged ordinarily within a room as a piece of furniture and adapted to be held in place on the outside of the window as a balcony in case of fire to allow a person or persons to take refuge on the balcony for protection from the flames and smoke in the room and for convenient reach by the firemen.

FOLDING CRATE.—A. A. SMITH, Evart, Mich. In the production of this knock-down receptacle, the object in view is to offer to shippers a new and improved crate, plain and durable in construction, cheap to make, easily set up, and arranged to fold into a relatively small space for convenient transportation without danger of losing or misplacing any of the parts.

FLOATING FISH-TRAP.—A. C. BURDICK, Seattle, Wash. The purpose of this contrivance is to provide a pot-seine to be used with or without scows and adapted to fish only with the tide and to be held by leads or guides, one at each side. The seine can be made of variable depths, according to the species sought to be caught. The especial purpose is to furnish a seine with a central pot and pockets at each side of the pot, passages leading to the pockets, and central pockets at the rear of the pot communicating with the side pockets and with a tunnel common to the rear pockets.

CANDY-DIPPER.—F. C. SPANG, La Crosse, Wis. This invention relates to improvements in devices for dipping candy in chocolate or other coating material, the object being to provide a dipper of simple construction by means of which candies may be rapidly dipped and uniformly coated.

EXHIBITOR.—A. G. and D. H. MCCULLOCH, Winnebago City, Minn. This mechanism provides a cabinet especially adapted for the display of laces, but which may be also used to show ribbons or similar articles capable of being wound upon and unwound from spools or reels. The cabinet is made to consist of a body-receptacle having doors, for example, on three sides, for the display of samples within the cabinet, and one or more rack-sections capable of withdrawal from the body-receptacle, each of which rack-sections have shafts operated from the exterior of the rack-sections of the cabinet, on which shafts spools of any size and number needed are mounted, turning with the shafts, to display and render accessible any piece or pattern of goods. Guide or feeding strips for lace, etc., prevent articles from folding or creasing while being wound or unwound.

AUTOMATIC TOY.—R. H. and R. D. ADAMS, Minneapolis, Minn. These inventors have designed an automatic toy representing a vehicle conveying articles from one point to another. It comprises a chute, on which is mounted a movable vehicle, a revoluble roller, a weight heavier than the vehicle and connected thereto by a cord over the roller, a magazine with a movable stop, a number of bodies to be placed loosely within the magazine at will, and a trigger controllable by movements of the vehicle for discharging the movable bodies one at a time into the vehicle.

DOUBLE-SEAT KNOCKDOWN CHAIR.—H. MORTON, Thomasville, N. C. This furniture device provides a new and improved double-seat knockdown chair arranged to permit of packing into a comparatively small space for shipping, storing and other purposes, and to allow the user to readily set up and connect the several parts to form a chair of great durability and strength.

STRAINER.—G. L. WACKEROW, Millette, S. D. Mr. Wackerow is the inventor of an improvement in automatic strainers intended especially for use on water-supply pipes of steam-boilers, pumps, etc., but it may be used wherever it is desired to strain sediment or other substances out of water.

DESIGN FOR A SIGN-BOX.—J. N. EARLY, New York, N. Y. This design relates to signs for giving the names of streets on which the signs are located. It consists of an ornamental base resting on brackets, radiating from a capital, and from this base rise paneled sides, surmounted by an ornamental head, from which rises centrally a short post, carrying a cap.

GARMENT-HANGER.—A. F. BARNUM, Binghamton, N. Y. The purpose of this invention is to provide means for hanging trousers so that the proper shape is retained. The device comprises a supporting member and independently-mounted hanger-frames which are capable of being folded back against the support or of extending outward into active position. The whole may be supported from a single hook.

TOY GUN.—J. B. POPENHAGEN, Chicago, Ill. In the invention of this article, the object is to provide a new and improved toy gun which is simple and durable in construction, not liable to get easily out of order, and arranged to propel beans and similar projectiles with great force and accuracy.

TRAMMEL—C. M. VAN HORN, Princebay, N. Y. The purpose of this instrument is to accurately describe arcs and radii of circles, particularly large circles in architectural work. A peculiarly-constructed marker is employed, to which is connected one end of a tape, the other end being connected with a center pin and holding device. By running the marker along the tape any radius may be attained and the arc described by sweeping the marking device around the center pin.

DENTAL CHARCOAL POINT.—L. ARNDT, Jersey City, N. J. This invention relates to charcoal points for dentists' use. The purpose is to provide a pure charcoal point for introduction into the nerve or root canals of teeth to be filled or capped in order to completely close the canals and to provide a support for the filling at the entrance of the canals and, further, to so shape the points that they will be curved to conform to the curvature of the canals. The invention also provides a process for making charcoal points by first shaping them in plain wood, then carbonizing the wood into charcoal.

JOINT FOR SHEET METAL PIPES.—J. B. WALLACE, Camden, S. C. In this improvement, meeting sections of pipe may be easily overlapped and locked immovably, thus preventing the sections from pulling apart at the joints. The union of the lengths and the uncoupling can be made without special tools and by unskilled labor, and the pipe manufactured rapidly. The construction allows close packing for favorable storage and shipping.

PORTABLE PLEASURE-TENT.—C. U. KRIEG, SR., Nashville, Tenn. For purposes of comfort, rest, recreation, or advertising, the inventor furnishes this pleasure-tent. It is especially adapted for the use of invalids and children, and is suitable as a studio for literary or artistic work or for games, as well as a protection against insects and inclement weather, and is well adapted to receive a swing, a hammock, automatic fans, etc.

PRESERVING-JAR.—MARY E. PERLEY, Perris, Cal. To avoid the tendency of the top layer of preserved fruits or vegetables to become moldy and spoiled, and to escape the necessity of inverting the jar, means are adapted in the present case for keeping the topmost layer of preserves below the level of the syrup or liquid matter in the substance. The improvement resides in a displacer forming a part of the cover of a jar or other vessel. It is fastened removably to the cover so that the parts may easily be separated for cleansing.

PIPE CONNECTION.—L. G. COLLINS, Alice, Texas. Mr. Collins is the inventor of an improved means of connecting the T which joins the pipe of a windmill-operated pump to a cistern-pipe, although it may be used where any T or elbow is to be joined to a pipe. The invention solves many difficulties encountered by present methods of connection.

OIL-BURNER.—C. W. SIEVERT, Los Angeles, Cal. This invention is allied to that class of apparatus intended for burning oils, particularly the heavy oils, such as crude petroleum, and comprises certain novel features of construction by which Mr. Sievert is enabled effectively to gasify the oil and mix it with air so as to obtain thorough combustion.

RETURN-BALL ATTACHMENT FOR POOL TABLES.—P. LAPP, Brooklyn, N. Y. In this case, runways are provided at each side of a table extending from one corner-pocket at a side to the other at the same side and beneath the center pockets. These ways incline downward toward the front end of the table where the ways are connected by a box to receive the balls. The attachment does not extend beyond the vertical plane of the side and end sections of the table bed, to interfere with players. Devices are provided to prevent stoppage of one ball on the ways by a second ball quickly following.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 3835.—For manufacturers of machines that will cut fruit and vegetables into small blocks or cubes,

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 3836.—For makers of hydraulic and screw presses.

Coin-operated machines. Willard, 284 Clarkson St., Brooklyn.

Inquiry No. 3837.—For makers of iron drawer locks.

Dies, stampings, specialties. L. B. Baker Mfg. Co., Racine, Wis.

Inquiry No. 3838.—For makers of armature disks 3¼ inches in diameter with 12 slots therein.

Blowers and exhausters. Exeter Machine Works, Exeter, N. H.

Inquiry No. 3839.—For makers of large steam gongs for fire alarms.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St. Chagrin Falls, O.

Inquiry No. 3840.—For a water motor working on the principle of a water meter, and give about 1 h. p.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 3841.—For wooden screws 3 to 5 in. long and ⅜ in. diameter and blocks with threads cut in them to match.

For metal articles, any kind, made any shape, write us. Metal Stamping Company, Niagara Falls, N. Y.

Inquiry No. 3842.—For makers of tile machinery.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 3843.—For harness-making machinery.

SAW MILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 3844.—For an automatic colored button machine.

If you want any metal novelty manufactured or metal working dies write Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 3845.—For a power loom for weaving wire fence.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 3846.—For manufacturers of flexible drills.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 3847.—For makers of slot machines for water.

Crude oil burners for heating and cooking. Simple, efficient and cheap. Fully guaranteed. C. F. Jenkins Co., 1103 Harvard Street, Washington, D. C.

Inquiry No. 3848.—For manufacturers of mutoscopes.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 3849.—For parties engaged in enameling and nickeling bicycles,

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc. Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 3850.—For small novelties for the mail order business.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 3851.—For makers of tubes with screw top.

WATER POWER FOR SALE.—Reliable 1,500 horse power located in State of New York. Owner would equip and rent power. Davidson, Box 773, New York.

Inquiry No. 3852.—For a jointed handle flue scraper for water tube boilers.

WANTED.—One of the "Simple Electric Motors" described in the Scientific American Supplement, April 14, 1888. State price and what year the motor was made. The older the better. Address Motor, P. O. Box 773, New York.

Inquiry No. 3853.—For makers of rotary engines or steam turbines.

PATENT FOR SALE.—Automatic envelope sealing and feeding machine, 250 office envelopes per minute. Great labor saver. Recently patented. See half page notice, this paper, October, 25, 1902. W. W. Gavitt & Co., Bankers and Brokers, Topeka, Kansas.

Inquiry No. 3854.—For manufacturers of gas holders of from 1,000 to 5,000 feet capacity.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits, Early American Illustrated Magazines, Early Patents signed by Presidents of the United States. Valentine's Manuals of the early 40's. Correspondence solicited. Address C. A. M., Box 775, New York.

Inquiry No. 3855.—For makers of automatic tag machinery.

WANTED.—Agency for agricultural implements, farming and household requisites, fencing wire, standards, etc., by an old established firm, in the midst of a large farming population. References: The Standard Bank of South Africa, Ltd., Robertson, C. C. Apply James O'Connor, Ashton, Cape Colony, South Africa.

Inquiry No. 3856.—For makers of card slot machines.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 3857.—For makers of small water motors.

Inquiry No. 3858.—For makers of brush-making machinery.

Inquiry No. 3859.—For a small hand machine for mixing powders evenly.

Inquiry No. 3860.—For manufacturers of novelties of every description.

Inquiry No. 3861.—For makers of turned handles for fishing reels.

Inquiry No. 3962.—For dealers in machinery for manufacturing snuff.

Inquiry No. 3863.—For a small kitchen utensil used for making steak meat tender without making it into sausage meat.

Inquiry No. 3864.—For makers of transparent platinum mirrors.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8852) W. J. V. asks if there is anything that will keep down the odor of oil when it is burned in lamps or stoves for heating purposes. A. Very careful regulation of the wick, so that it burns without a trace of smoking, is the only way in which the odor can be kept down to a minimum. It is practically impossible to have it burn entirely without odor. The burner should be well cleaned.

(8853) S. M. C. asks for a preparation to apply upon a cotton fabric that, after it becomes hard and dry, it will also become very flexible and not crack. We would prefer something thick, so as to cover up the meshes in the woven fabric. A. Practically the only kind of coating that would answer the requirement of becoming thoroughly dry, and still very flexible, is rubber. Linseed oil varnish, if sufficient time can be given to insure thorough drying and hardening, will give a coating of some flexibility: it would have the advantage over rubber of being easier to apply, and more readily admitting of mixing in coloring matters, if desired.

(8854) C. E. H. wishes cement which he could make or buy for fastening pieces of glass together, and which after hardening could be submerged in water without being affected unfavorably. We do not contemplate making water-tight joints with the cement, but simply to hold pieces of glass rigidly in place under water for experimental purposes. A. 1. Use Canada balsam, alone or slightly diluted with turpentine. 2. Dissolve 5 to 10 pints gelatine in 100 parts water; add 10 per cent of a concentrated solution of bichromate of potash, mix thoroughly and keep in a dark place. When the articles joined by this cement are exposed to sunlight for a short time, the cement becomes tough and insoluble in water. 3. Mix 4 parts quicklime, 6 parts litharge, and 1 part of linseed oil varnish.

(8855) D. W. K. asks how to make a solution of iron to be deposited by a battery in small quantity; also if a small Smee battery would be strong enough to deposit it, or what kind of battery should I require? A. Use either a solution of the double ferrous ammonium sulphate, or a mixture of 4 parts sulphate of iron and 3 parts sal ammoniac, dissolved in 30 parts of water. Use an iron plate or netting as anode. A Smee cell will do, but the Daniell cell is cheaper and will give as good results.

(8856) A. M. L. asks: Is it possible for four men to lift without straining, a heavy man lying rigid upon the floor? It is claimed that by the four men inspiring in unison while the one to be lifted is expiring, they can lift him like a feather A. We do not think it is possible for "four men to lift a heavy man lying rigid upon the floor," without any exertion on their part. The only explanation we can offer for this experiment is that the act of attention to breathing together distracts attention from the effort of lifting. We have no doubt whatever that a dynamometer placed between the hands of the lifters and the man to be lifted would show that a real stress was put forth equal to the weight of the man lifted. It is not a great effort to lift a quarter of a man, and one can do it without taking much notice of the effort. The explanation is strictly psychological. There are many similar examples of putting forth great efforts without being conscious of it, as, for example, one escaping from a burning building, and carrying a person in his arms, may do feats of strength without knowing it, which would not be possible under ordinary circumstances.

(8857) W. A. J. wants to know where he can procure a luminous paint (one that is readable at night) and its price, or can you give me a recipe for making it? Can you also tell me of a paste, cement, or something for fastening paper letters on the rear side of glass? A. Calcium sulphide is considered the best material for luminous paint. Devoe & Raynolds can probably supply same. Dissolve 30 parts gum tragacanth and 120 parts gum arabic in 300 parts of water. Then add 2½ parts of thymol mixed into 120 parts of glycerine. Finally add water enough to bring up to 1,000 parts. The thymol acts as preservative, and the glycerine prevents drying out and consequently springing loose from the glass.

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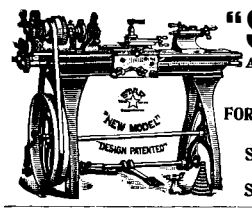

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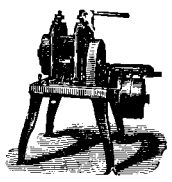

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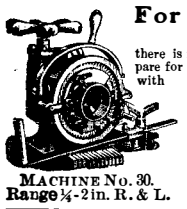

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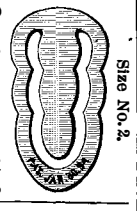

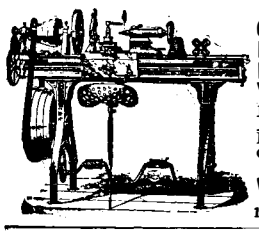

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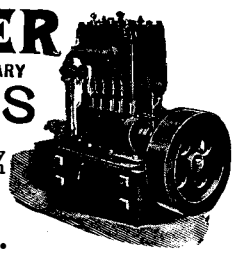

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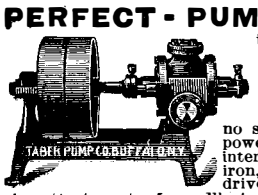

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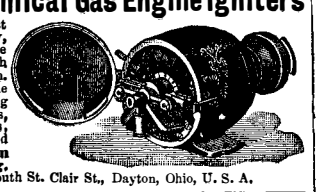

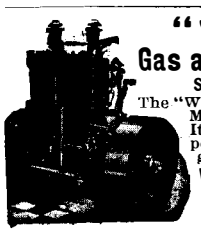

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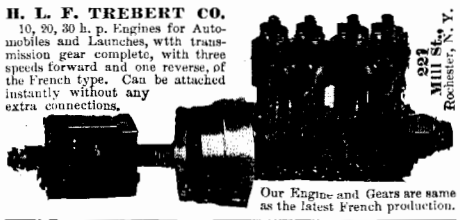

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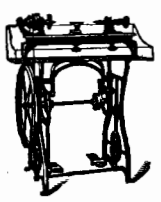

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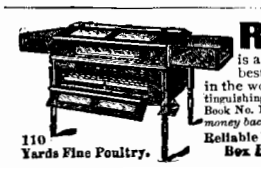

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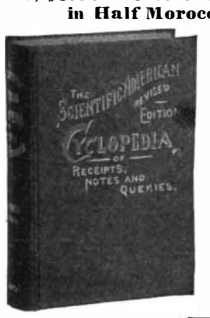

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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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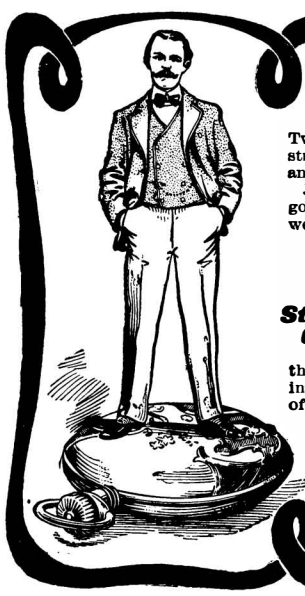

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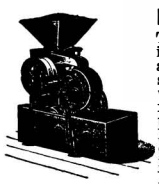

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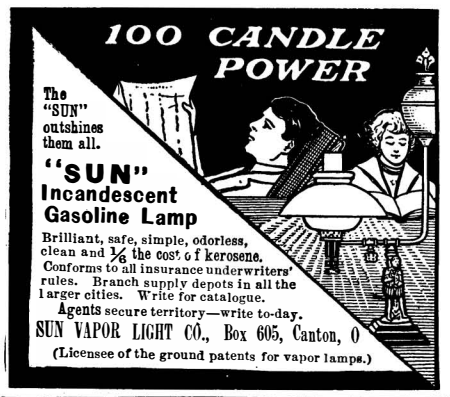

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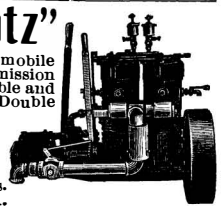

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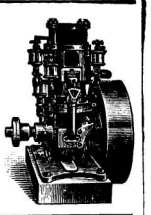

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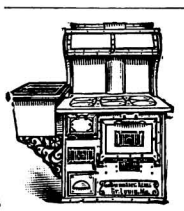

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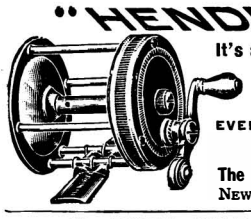
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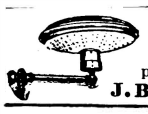
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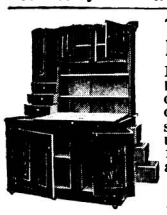
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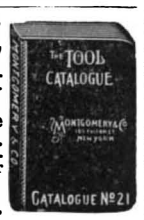

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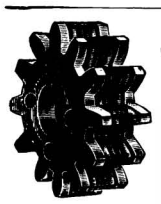
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CIVIL ENGINEER'S POCKET BOOK. By John C. Trautwein, Civil Engineer. Revised by John C. Trautwein, Jr., and John C. Trautwein, III. New York: John Wiley & Sons. 1902. Pp. 1078.

For many years Trautwein's book has been, perhaps, the most consulted reference work to be found on the civil engineer's and the mechanical engineer's desk. Its tables have always proven trustworthy and of great intrinsic value. The present edition is the eighteenth. Its revisers have made not a few changes which, it must be confessed, have improved the work. The most radical and extensive of all the changes are those on trusses, etc. The chapters have there been almost entirely rewritten and completely modernized. More than 370 pages of new matter have been added. Consequently the new edition is considerably larger than its predecessors.

A DISCUSSION OF COMPOSITION ESPECIALLY AS APPLIED TO ARCHITECTURE. By John Vredenburgh Van Pelt. New York: The Macmillan Company. London: Macmillan & Co., Ltd. 1902. Pp. viii, 275.

The present discussion of composition is divided into six parts. The first treats of the general laws of character and art; the second, general technical laws; and the last four have to do with applications, the third and fifth being respectively theoretical discussions of decoration and plans; the fourth and sixth contain practical suggestions on the same subject. Since an analysis of composition is necesarily more negative than positive, it follows that the author's method of explaining consists more in pointing out what should not be done rather than what should be done.

ELEMENTS OF ELECTRICAL ENGINEERING. A First Year's Course for Students. By Tyson Sewell. New York: D. Van Nostrand Company. 1902. 12mo. Pp. 332. Price $3.

Considered as a treatise on elementary engineering or—as the sub-title of the book more aptly terms it—"A First Year's Course for Students," it cannot be denied that the work before us has merit. But as in most books of this character, the arrangement is open to criticism. To begin with Ohm's law is undoubtedly a good plan, but the author's steadfast adherence to the time-honored method of explaining the law is hardly to be considered an aid to clearness. For an elementary book the work sometimes goes into too much detail, and sometimes omits important subjects. It seems to us unnecesary to have discussed so elaborately manufacturing processes, and it might have been advisable to have included something of the alternating current, which plays so important a part nowadays in long-distance transmission.

RECIPES FOR THE COLOUR, PAINT, VARNISH, OIL, SOAP AND DRYSALTERY TRADES. Compiled by an Analytical Chemist. London: Scott, Greenwood & Co. New York: D. Van Nostrand Company. 1902. Pp. 347. Price $3.50.

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BACTERIAL TREATMENT OF CRUDE SEWAGE. Fourth Report by Dr. Clowes. Experimental Treatment of London Crude Sewage in Settling-Tanks and Coke Beds at Barking and Crossness. Presented to the Main Drainage Committee of the Council by Prof. Frank Clowes, D.Sc. (London) F.I.C. (Chief Chemist to the Council), on April 17, 1902. James Truscott & Son. Ltd., Suffolk Lane, Cannon Street, E. C.

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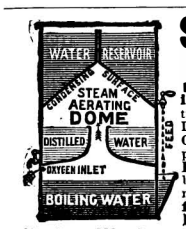

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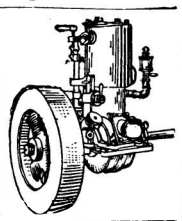

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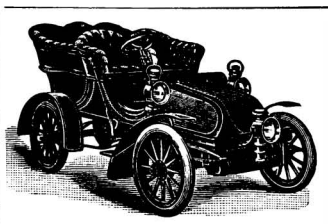
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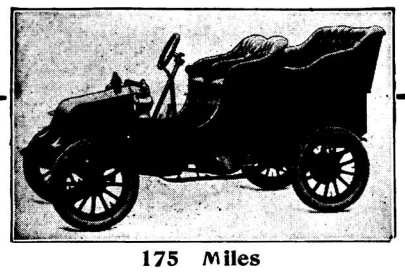

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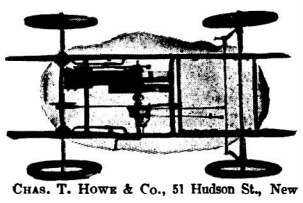

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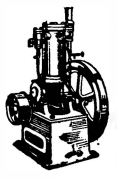

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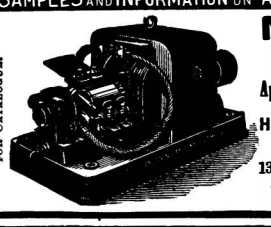

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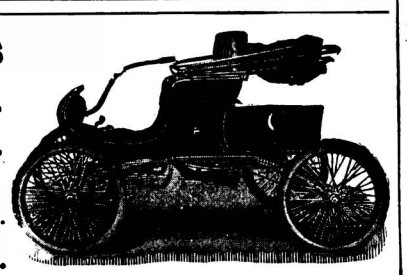

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